H.R. 1268 — THE NATIONAL BIOLOGICAL DIVERSITY CONSERVATION AND ENVIRONMENTAL RESEARCH ACT

HEARING

BEFORE THE

SUBCOMMITTEE ON NATURAL RESOURCES,
AGRICULTURE RESEARCH AND ENVIRONMENT

OF THE

COMMITTEE ON
SCIENCE, SPACE, AND TECHNOLOGY
U.S. HOUSE OF REPRESENTATIVES

ONE HUNDRED FIRST CONGRESS

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CONTENTS

WITNESSES

May 17, 1989: Page
- Dr. Thomas E. Lovejoy, Assistant Secretary, External Affairs, Smithsonian Institution 6
- Dr. Donald A. Falk, director, Center for Plant Conservation 13
- Dr. W. Donald Duckworth, president and director, Bishop Museum, on behalf of American Institute of Biological Sciences 22
- Dr. Peter R. Jutro, Acting Director, Marine, Freshwater, Modeling and Global Change Research, Environmental Protection Agency 36
- George M. Leonard, Associate Chief, Forest Service, Department of Agriculture 49
- Dr. John D. Buffington, Deputy Regional Director for Research, Fish and Wildlife Service, Department of the Interior 58
- Dr. M. Rupert Cutler, president, Defenders of Wildlife 91
- David Ford, director, government affairs, National Forest Products Association 103
- John Heissenbuttel, manager, research and policy, American Forest Council 112
- Dr. Donald M. Waller, associate professor of botany, University of Wisconsin, on behalf of Sierra Club 121

Appendix—Additional material for the record 183

H.R. 1268—THE NATIONAL BIOLOGICAL DIVERSITY CONSERVATION AND ENVIRONMENTAL RESEARCH ACT

WEDNESDAY, MAY 17, 1989

House of Representatives, Committee on Science, Space, and Technology, Subcommittee on Natural Resources, Agriculture Research and Environment,

Washington, DC.

The Subcommittee met at 1:35 p.m., in room 2318, Rayburn House Office Building, Hon. James H. Scheuer, chairman, presiding.

Present: Representatives Scheuer, Price, McMillen, Schneider, Henry, Morrison, and Smith of Texas.

Also present: Eileen Lee, Science Consultant; Michael Rodemeyer, Staff Director and Counsel; and Wesley Warren, Republican Technical Consultant.

Mr. Scheuer. The Subcommittee on Natural Resources, Agricultural Research and Environment will come to order.

Today, we will consider H.R. 1268, the National Biological Diversity Conservation and Environmental Research Act, which I am proud to have authored.

[The complete prepared opening statements of Mr. Scheuer and Ms. Schneider follow:]

Congressman
James H.
Scheuer

HONORABLE JAMES H. SCHEUER

HEARING ON

H.R. 1268, "THE NATIONAL BIOLOGICAL DIVERSITY CONSERVATION AND ENVIRONMENTAL RESEARCH ACT"

MAY 17, 1989

The Subcommittee on Natural Resources, Agriculture Research and Environment will come to order. We will consider H.R. 1268, The National Biological Diversity Conservation and Environmental Research Act, which I am proud to have authored.

The bill restores U.S. leadership in the global effort to conserve precious biological resources ranging from our natural genetic bank to ecosystems and the services that they provide. It also establishes a comprehensive and integral procedure that collates our understanding of biological diversity and uses this information in ecosystem management.

Specifically, the bill:

- Establishes a national policy to conserve biological diversity as self-sustaining plant and animal populations in intact ecosystems.
- Directs the development of a Federal conservation strategy.
- Creates a National Center for Biological Diversity and Conservation Research.
- Requires environmental impact statements to contain information on how Federal actions would effect biological diversity.

Beginning with the request to the Office of Technology Assessment that resulted in the excellent report, Technologies to Maintain Biodiversity, the Subcommittee has engaged in a consultative process involving Federal agencies, Members of Congress, the scientific community, conservation groups, and natural resource industries.

Since the Subcommittee's last hearing on biological diversity, there have been several significant developments.

In December, the Center for Plant Conservation released its report with the shocking information that some 700 plant species will become extinct in the U.S. in the next 10 years if we do not intervene.

In March, the National Science Board approved a report calling for a major research effort to understand and conserve biological diversity. This was accompanied by a request for an $11 million biodiversity initiative in the National Science Foundation budget. This request was authorized by the Science Committee.

Also in March, an independent commission proposed sweeping changes to the National Park Service including ecosystem management, expansion of research activities, and expansion of educational programs on environmental issues.

According to TIME magazine, 1988 will be remembered as "the year that the planet struck back." The severe drought and fires of last summer gave us but a mild taste of what life in the U.S. will be like when the greenhouse effect is in full force.

We lost well over two thousand species last year. Many of these losses were in the tropics, but the U.S. was not held safe from the devastation. Scientists report that the rate of deforestation in Florida is greater than in Brazil.

Another area of concern for the U.S. is the fact that the Forest Service clear-cuts approximately 60,000 acres of virgin forest in the Pacific Northwest annually, and has plans to eliminate more than half of the remaining old-growth forests with disastrous consequences for many species including the spotted owl.

Other habitats are also vanishing in the U.S., such as wetlands which are being destroyed at a pace of 250,000 acres per year. Hawaii, the national jewel of biological diversity, is also the capital of endangered diversity, representing 25% of the species listed on the Endangered Species List.

Today, we will hear the future plans of Federal Agencies regarding biological diversity. Historically, the government's actions have been piecemeal, uncoordinated and largely reactive to past disasters. We will also receive testimony from environmental groups and industry representatives concerning the legislative approach to conserving biological resources.

I am pleased to open this hearing and announce my plans to move quickly on this legislation. Before we hear from our distinguished witnesses, let me turn to my fellow biodiversity activist and leading cosponsor of H.R. 1268, Representative Claudine Schneider of Rhode Island.

OPENING STATEMENT OF CLAUDINE SCHNEIDER
HEARING ON HR 1268
THE NATIONAL BIOLOGICAL DIVERSITY CONSERVATION AND ENVIRONMENTAL RESEARCH ACT
MAY 17, 1989

I WOULD LIKE TO COMPLEMENT THE CHAIRMAN FOR HOLDING A HEARING ON THIS VITALLY IMPORTANT SUBJECT. CHAIRMAN SCHEUER HAS BEEN ONE OF THE TRUE LEADERS IN THE FIELD OF BIOLOGICAL DIVERSITY. FURTHERMORE, I AM GLAD TO BE A COSPONSOR OF HIS BILL, H.R. 1268, AND LOOK FORWARD TO WORKING WITH HIM IN THE FUTURE.

THE LOSS OF BIOLOGICAL DIVERSITY ON A GLOBAL SCALE IS A TRAGIC TREND THAT THREATENS ALL OF US.

- MUCH OF THIS LOSS IS OCCURRING IN TROPICAL RAIN FORESTS, WHERE AN AREA GREATER IN SIZE THAN THE STATE OF NEW YORK IS DESTROYED EVERY YEAR (THAT TRANSLATES INTO 74 RHODE ISLANDS A YEAR).

- AS A RESULT, OVER A HUNDRED SPECIES BECOME EXTINCT WORLDWIDE EACH YEAR; EVEN IN THE UNITED STATES, THOUSANDS OF ANIMAL AND PLANT SPECIES MAY BE ENDANGERED.

- MANY OF THESE SPECIES BECOME EXTINCT BEFORE WE CAN STUDY THEM TO DETERMINE THEIR POTENTIAL VALUE.

WHY DOES THIS LOSS MATTER? BIOLOGICAL DIVERSITY IS IMPORTANT FOR ECONOMIC, MEDICAL, AND ECOLOGICAL REASONS. HERE ARE JUST A FEW EXAMPLES:

- COMBINED FARM SALES AND IMPORT VALUE OF DOMESTICATED WILD SPECIES IS WELL OVER $1 BILLION PER YEAR IN THE U.S.; AGRICULTURAL ADVANCES OFTEN DEPEND UPON CROSSBREEDING WITH PREVIOUSLY UNCULTIVATED PLANT SPECIES FOUND IN THE WILD, SUCH AS THE KIWIFRUIT, HIGHBUSH BLUEBERRY, AND WILD RICE.

- PLANT EXTRACTS ARE USED IN ABOUT 25% OF THE PRESCRIPTION DRUGS IN THE U.S. MARKET, WHICH TOTALS $15 BILLION ANNUALLY; THE ROSY PERIWINKLE FOR EXAMPLE PROVIDED A PREVIOUSLY UNAVAILABLE CURE FOR LEUKEMIA.

- A RECENT OTA REPORT IDENTIFIED THE LOSS OF BIOLOGICAL DIVERSITY AS A MAJOR THREAT TO THE SURVIVAL OF FUNDAMENTAL ENVIRONMENTAL PROCESSES.

WHAT NEEDS TO BE DONE?

- WE NEED A U.S. POLICY THAT IS PROACTIVE NOT REACTIVE. NOW BY THE TIME WE REALIZE A PROBLEM EXISTS IT IS TOO LATE TO EASILY CORRECT THE SITUATION. ONCE SPECIES BECOME EXTINCT THEY ARE LOST FOREVER.

- WE NEED TO STRENGTHEN RESEARCH THAT LOOKS AT ENVIRONMENTAL TRENDS IN A COMPREHENSIVE MANNER. EPA'S NEW INITIATIVE, THE

ENVIRONMENTAL MONITORING AND ASSESSMENT PROGRAM (KNOWN AS E-MAP), IS A GOOD START, BUT EVEN MORE WILL BE REQUIRED.

- WE NEED TO EXERT LEADERSHIP INTERNATIONALLY. MANAGEMENT OF OUR OWN RESOURCES WILL SET THE RIGHT EXAMPLE FOR OTHER COUNTRIES.

THIS BILL, H.R. 1268 WILL GO A LONG WAY TO CONSERVE OUR NATURAL RESOURCES FOR FUTURE GENERATIONS. I LOOK FORWARD TO TODAY'S HEARING AS ANOTHER STEP IN ACHIEVING THAT GOAL.

Mr. **Scheuer**. We have a very solid group of witnesses here this afternoon. We are going to take as our first witness Dr. Thomas E. Lovejoy. Dr. Lovejoy is leaving for Brazil immediately after this hearing to pursue his marvelous efforts to induce the Brazilians to harvest their tropical rain forest on a sustainable yield basis. We are very grateful to him for having made his schedule to permit him to appear before the subcommittee. We are honored with his presence. He ennobles our work.

In deference to his time schedule, I ask unanimous consent for both the chairman and the ranking minority member to defer their opening statements until after Dr. Lovejoy has had an opportunity to testify and to answer some of our questions. And when Dr. Lovejoy takes off for Dulles Airport, then we will both make our opening remarks.

So, Tom Lovejoy, we are delighted to have you today. It is a great privilege. We very much appreciate the efforts you have made to integrate our schedule with your departure for Brazil.

Please take such time as you may need, not more than 10 minutes, and then I am sure we will have some questions for you before bidding you adieu.

STATEMENT OF DR. THOMAS E. LOVEJOY, ASSISTANT SECRETARY, EXTERNAL AFFAIRS, SMITHSONIAN INSTITUTION

Dr. **Lovejoy**. Thank you, Mr. Chairman and Congressman Schneider.

It really is no longer necessary, I believe, to review the case for why we need to be concerned about our flora and fauna, collectively known as biological diversity, but I would in beginning just note that biological diversity can also be looked at as a measure of whether ecological systems have had their carrying capacity surpassed. And indeed, if you look at our global environmental problems and the global atmospheric pollution and the rate of species loss from the planet, it is clear that the way we currently live on this planet has exceeded its carrying capacity.

Similarly, I would make the case that the best measure of sustainable use is whether the economic activity that goes on in a large unit of landscape is such that it is able to maintain its biological diversity over time.

And all of that means that the question of biological diversity can no longer be thought of in terms solely of protected areas of conservation units and national parks, and it is clear equally that existing systems and indeed the Endangered Species Act itself have proved themselves insufficient to the task of protecting our biological heritage.

I would therefore like to congratulate you, Mr. Chairman, and Congressman Schneider, on H.R. 1268, which endeavors to set a new direction in our approach to biological diversity.

I think what is really needed and which this bill attempts to address is a new approach where scientific data, the scientific data necessary for intelligent conservation action, are generated independent from but linked to policy. There is a need to marry many disparate interests, the interests of the scientific community, those working in biological systematics who traditionally have worked at a very stately pace as they endeavor to work out a picture of the variety of life on Earth and the relationships amongst species, and also the question of databases, which is a very unglamorous but very vital basis for both making immediate conservation decisions about what areas need special protection or management but also for monitoring, and one needs to marry as well that to conservation action, the need to move very fast in a time of real peril for our biological resources.

What we need and what the National Center is envisioned as doing is an operation which can piece together existing efforts into a coherent picture, identify gaps in that picture, work when necessary at a very rough and rapid manner so that in the way that epidemiologists work with studies of diseases transmitted by unknown species of mosquitos they are able to recognize the individual morphotype and simply proceed with a provisional identification, even a number, as they study the whole system, so that the refinements of the relationships of those particular species can be worked out far in the future but, in analogy here to conservation, the necessary action based on the knowledge that they exist can take place so they in fact will be there to study in the future.

I also think it's important to look at this as an iterative process of a need for the National Center to provide periodic snapshots of the state of biological diversity in this country, snapshots that can be used as a base for action, for development of policy, but actions and policies that can be modified and refined when the next snapshot is produced and our state of knowledge is better.

There simply is no time to operate in a linear fashion and study the biological diversity of this country in full detail and then, when that enormous task is finished, move to action. We need to be working on both fronts at once, and that is what this bill endeavors to organize.

A few remaining points. I think the National Center, wherever it is, wherever it eventually is placed, must have a scientific and not an agency base. I think it absolutely critical that we maintain what I think of as a necessary tension between scientific fact, scientific assessments, and agency implementation. I think it is the only way to drive the process properly.

Furthermore, the National Center must not attempt to do the whole job itself. It must coordinate, it must find ways to bring resources to various existing parts of the enterprise and indeed resources to parts of the enterprise that need to be created, and do the whole thing in a symphonic sense rather than solo.

Finally, I would say that the importance of this bill is considerably greater than one can measure by the biological diversity of this country by itself because as anybody who is familiar with the world conservation picture knows, the example that this country sets is absolutely critical. And if we cannot be seen to be making a strong effort to do the right thing here, how can we possibly hope that the poorer countries, which have the vast amount of biological diversity, possibly undertake similar efforts?

So, I think I will leave that initial statement at that, if I may, and be willing to answer any questions you may have.

Mr. Scheuer. Well, thank you very much, Dr. Lovejoy, for your really splendid and encouraging and, may I say, inspirational remarks. We are all very grateful.

David, Dr. Lovejoy has to catch a plane to Brazil immediately after his testimony, so I have asked unanimous consent for the members' opening statements to be deferred until after Dr. Lovejoy's testimony and after he has had a chance to answer some of our questions.

So, we will ask him some questions and receive his answers, and when he is finished we will then make our opening statements. All right?

Mr. Price. Right. Thank you, Mr. Chairman.

Mr. Scheuer. Okay.

Dr. Lovejoy, do we have enough precise information? Is our knowledge base sufficiently well organized and precise for us to know the causes of the losses in biological diversity and to enable us to take sensible, realistic, cost-effective measures such as we think and hope are proposed in this bill? Does the state of the science permit us to shoot with a high-powered rifle and an eight-power scope rather than with a shotgun, splattering our pellets all over the landscape?

Dr. Lovejoy. Again, I think we are sort of in this position needing to develop knowledge and ways to become more effective through both developing the picture of biogeographic pattern and understanding of conservation biology of different kinds of systems and different kinds of species, but at the same time needing to make some decisions right now.

And, yes, in a very broad sense, we know what a lot of the causes are, but when it comes down to how one can actually tinker with an individual species or an individual system, we are woefully ignorant.

Mr. Scheuer. This is the knowledge that you would hope that this bill and these programs would adduce?

Dr. Lovejoy. That is absolutely critical.

Mr. Scheuer. Now, under this bill, the Smithsonian will sort of organize and manage the Center, as it is described in H.R. 1268. Do you feel confident that the Smithsonian is capable of carrying out that mission?

Dr. Lovejoy. Well, I think it has to be set up with clear directions in the bill as to its purposes. It most likely should be set up as a separate entity or bureau within the institution and with a strong advisory board which can oversee it. But given that, yes, sir.

Mr. Scheuer. All right.

Now, the products of the Center must be directly applicable to resource policy and resource management. Are there any institutional barriers, are there any constraints that might impede or even prevent the Smithsonian from carrying out such policy-oriented research?

Dr. Lovejoy. In my view, the Smithsonian can get right to the absolute brink of setting policy, then it must stop. But it can very easily just set out what needs to be done; that is just simple scientific fact.

Mr. Scheuer. All right.

Now, do you think the Smithsonian would be capable of achieving the cooperation of other Government agencies such as the Fish and Wildlife Service and the EPA in carrying out its mission?

Dr. LOVEJOY. Well, we would certainly give it our very best effort.

Mr. SCHEUER. Is there any experience in the past that indicates that smooth cooperation would be difficult or impossible, or would it be anticipated?

Dr. LOVEJOY. Well, actually, as far as the Fish and Wildlife Service is concerned, I mean there is a long, long relationship that goes back to the original biological survey and there are in fact Fish and Wildlife Service scientists who occupy some space in the Museum of Natural History. And goodness knows I have worked with Bill Reilly long enough and talked to him as recently as last night that I think we can make it work.

Mr. SCHEUER. Well, I suppose the presence of a guy of Bill Reilly's level of commitment and talent and knowledge and experience and credibility is a great advantage to us all when it comes to managing these programs, designing and managing these programs for which the EPA will be a very relevant presence. In the worst of times it might have been difficult, but certainly in terms of everything that Bill Reilly stands for and offers, it should be easy to work with a guy of his level of talent and commitment and to accrue and achieve the cooperation of his agency and the staffers who work with him and below him in the pecking order.

Dr. LOVEJOY. Oh, I think we should seize the moment.

Mr. SCHEUER. Yes, I agree.

Would the policy relevance of the Center be enhanced by any kind of shared management with either of these two agencies, either EPA or Fish and Wildlife? Would any kind of shared management make sense, or would you prefer the direction and the ultimate control of the Center to vest exclusively in the Smithsonian?

Dr. LOVEJOY. I think probably the best way to approach this, since as you have just so eloquently made the point, agency effectiveness varies through time according to its leadership and various things, is that we not share the management in terms of a tripartite governance, but that the advisory board that is set up for the Center very definitely have representatives of those two key agencies so they are involved right in the discussions all along.

Mr. SCHEUER. Given the international orientation of the Smithsonian, its international cast, so to speak, how can we be confident that the functions of the Center to assess the status of U.S. biota will not be pushed aside and downgraded in favor of additional international activities and assessments and so on?

Dr. LOVEJOY. I think it is just a matter of defining what the Center will be. I mean it will be the intent of the Congress and the Smithsonian will follow the intent of the Congress.

Mr. SCHEUER. Okay. Thank you very much, Dr. Lovejoy.

My distinguished ranking minority member, a leader in the whole field of environmentalism and biological diversity, Claudine Schneider of Rhode Island.

Ms. SCHNEIDER. Thank you, Mr. Chairman.

There happens to be, if the words have not reached you yet, Dr. Lovejoy, a great deal of controversy as to whether or not the Smithsonian is the appropriate seat for the jurisdictional responsibility both in the area of research and in terms of policy. And I think that I would like for you to elaborate a little bit further as to making your case as to why you think that the Smithsonian would be the ideal location, given the fact that the responsibilities would be essentially two-fold: research and policy orientation?

Dr. **Lovejoy**. Well, I think you have to start with the very fact that the national collections of the flora and fauna of the United States are largely, or in great quantity, based right at the Smithsonian, and that is part of the kind of stuff that needs to be studied in developing the proper pictures.

And I think one also needs to make the point that it is a national scientific institution, it has a serious national responsibility in this regard which those of us in the administration feel very strongly.

I think the difficulty here is in the interpretation of what policy is. It is very, just to take it to the realm of global warming, for instance, I mean it is very clear to anybody who looks at the scientific facts that we are going to have to cut back on our dumping of carbon into the atmosphere as carbon dioxide. And that is just scientific fact, and it has to translate itself into policy.

Whether it should be the role of the Smithsonian to actually draft a piece of legislation is a different question. But we can certainly lay out the clear options and directions because that is just fundamental scientific analysis.

Ms. **Schneider**. Well, in the realm of scientific analysis, what do you perceive as being some of the key research needs that we have right now in the whole area of biological diversity?

Dr. **Lovejoy**. Well, I think there are two. One is developing a much deeper, more sophisticated understanding of biogeographical pattern; I mean what exists where and what are the threats to our flora and fauna. And from that, one derives a sense of where new protected areas need to be, where management policies need to be changed, et cetera.

But it is also very important to support the science of conservation biology beyond this area of survey and basic biogeography. And I should point out that I am the president-elect of the Society for Conservation Biology. So there is a bit of bias here.

There are a lot of things that need to be studied about how landscapes are managed, how particular species are managed, how particular communities are managed.

Ms. **Schneider**. But I am really wanting to focus, because we do get into a situation where we have to make recommendations for expenditures of money.

Dr. **Lovejoy**. Sure.

Ms. **Schneider**. If you were to narrow them down, would your first recommendation be the patterning and also the potential threats?

Dr. **Lovejoy**. The very first.

Ms. **Schneider**. And the second one being conservation biology, not necessarily one being more important?

Dr. **Lovejoy**. Conservation biology is not going to be a useful exercise in some senses unless that basic pattern of biogeography is developed. And there is no, at the moment, existing mechanism to make that happen.

Ms. SCHNEIDER. Okay. I have no further questions.

Thank you.

Mr. SCHEUER. All right.

I would ask unanimous consent that all of the Members of Congress have several weeks to submit questions by mail. We may have some for you when you come back from Brazil.

I ask unanimous consent that the record of the hearing be held open for a couple of weeks until Dr. Lovejoy's return.

There being no objection, so ordered.

Mr. SCHEUER. Congressman David Price of North Carolina.

Mr. PRICE. Thank you, Mr. Chairman.

Dr. Lovejoy, as you know, one of the key provisions in H.R. 1268, of which I am proud to be cosponsor, provides for environmental impact statements.

Section 5(d) of the bill amends the National Environmental Policy Act to explicitly require assessment of impacts on biological diversity in environmental impact statements. And then section 5(e) requires agencies to review their programs and take actions to remove inconsistencies with the goal of conservation of biological diversity.

As a practical matter, would you tell us how demanding those requirements would be? Would it be possible, given the knowledge and expertise now available to the affected agencies, for them to do what the bill requires of them? If not, what would it take to get them in a position to comply in a reasonable period of time?

Dr. LOVEJOY. I was afraid somebody might ask me that.

It really depends on what level of detail one wants to get. That is the real difficulty. If one wants to look simply at vertebrates and flowering plants and use just a small number of groups as sort of indicators of the whole biological community, then it is a much more achievable goal than if it was to be exhaustive, because basically if you push it to its logical limit you really have to know something about every single organism that is in the land area or whatever being affected.

Mr. PRICE. I think part of what we need to know from you is what level of detail we should be aiming for, what kind of impact statements is it appropriate to require?

Dr. LOVEJOY. My personal recommendation would be to begin by working with well-known groups of organisms like vertebrates, like flowering plants and maybe butterflies and dragonflies and get that working before one tries to operate in any greater detail, and maybe do some studies of how effective that actually seems to be. It would be very difficult to plunge into it in an exhaustive fashion.

Mr. PRICE. You think most of the affected agencies, though, would be prepared in fairly short order to do this first-stage kind of analysis?

Dr. LOVEJOY. It's really difficult for me to comment on their capabilities. There certainly is sufficient scientific manpower in this country and natural history-oriented manpower that one can find the necessary people. Whether they are in the agencies is a different question. And I would expect that many agencies are insufficiently staffed from that point of view.

Mr. Price. Obviously that is something we will need to pursue with the agencies themselves.

Thank you, Mr. Chairman. I know our time is limited.

Mr. Scheuer. Thank you, Congressman.

Congressman Paul Henry of Michigan?

Mr. Henry. Thank you, Mr. Chairman. I just have three very brief questions for Dr. Lovejoy.

First of all, is it fair to assume that you believe that such legislation as this is needed?

Dr. Lovejoy. Oh, absolutely. Absolutely.

Mr. Henry. Well, I will take my second question and see if I also get an "absolutely." Is it fair to say that such legislation is urgently needed?

Dr. Lovejoy. It is critically urgent.

Mr. Henry. And is it also fair to say then that the issue of the lead——

Mr. Scheuer. That was his third question. [Laughter.]

Is it critically urgent?

Mr. Henry. Is the issue then of the lead agency or the location of the Center implicitly secondary to the urgency of the legislation?

Dr. Lovejoy. Well, you know, you only have one shot at doing this right.

Mr. Henry. I understand that.

Dr. Lovejoy. And I would find it hard to put it second. I would put it coequal.

Mr. Henry. Well, I think that is what has some of us concerned in this, to be very frank with you. The urgency of this is very, very real. The significance of this bill is very, very real. And I think all of us would hate to see this issue become mired in the problem of bureaucratic politics, as significant as those questions can be, in terms of where it's placed. I think it would be a tragic failing if we let that kind of issue emerge.

Dr. Lovejoy. Well, I agree with that. You may have come in after I made the point that wherever it is placed, which means it could be in places other than the Smithsonian, has to be a scientific base and not an agency base.

Mr. Henry. Thank you, Dr. Lovejoy.

Thank you, Mr. Chairman.

Mr. Scheuer. Congressman Sid Morrison of the State of Washington.

Mr. Morrison. Thank you, Mr. Chairman. No questions of Dr. Lovejoy. Thank you.

Mr. Scheuer. Dr. Lovejoy, thank you very, very much. We all wish you godspeed on your journey, and go get them.

Dr. Lovejoy. Thank you, sir.

Mr. Scheuer. All right. We will now hear from the rest of the panel: Dr. Frank Talbot, director of the Museum of Natural History; Dr. Don Falk, director of the Center for Plant Conservation; and Dr. Donald Duckworth, president and director, Bishop Museum, on behalf of the American Institute of Biological Sciences.

Would you folks all come up to the witness table?

Without objection, we would ask for all members to have their opening statements placed and printed in full in the record prior to Dr. Lovejoy's testimony.

There being no objection, so ordered.

All right. Why don't you start out, take five or six minutes. And for the benefit of all the members of the panel, I will comment that your statements, as prepared, will be placed in full at the point in the record at which you testify. So you can just relax and chat with us informally, liberating yourselves to the extent possible from the printed word and just sharing your knowledge and insights with us.

Dr. Falk?

STATEMENT OF DR. DONALD A. FALK, DIRECTOR, CENTER FOR PLANT CONSERVATION

Dr. **Falk**. Thank you, Mr. Chairman.

There are in fact quite a few points that I belabored in my written testimony that I will not belabor here.

Mr. **Scheuer**. And of course don't hesitate to address anything that you have heard up to this point in the hearing, remarks or observations by Dr. Lovejoy or any of the concerns that you have heard from members of this panel.

Dr. **Falk**. Thank you. In fact, I will do that.

I like to think at this point that there are now two kinds of people in Washington: there are people who think it's important to conserve biological diversity for its own sake; and people who think it's important to preserve biological diversity for human benefit.

On the off chance that there may be some of your more recalcitrant colleagues who may need persuading on either point, I thought I would come down today to offer some testimony specifically on the issue of plant diversity, which is my personal area of expertise and the main work of the Center for Plant Conservation.

I should explain before I go any further that the Center for Plant Conservation is a national organization founded in 1984. We are the only organization in the country that is devoted specifically to endangered plant species. We maintain the national collection of endangered plants, which presently contains over 300 critically threatened species, or collaboratively with a wide range of Federal, State and private agencies. So chances are fairly good that if endangered plant diversity is the issue, the Center is involved or may already be involved in some respects.

I will refer you also to the report issued by the Office of Technology Assessments on strategies for conserving biological diversity which encapsulated some of the possible roles for the Center.

I want to speak very briefly just to four points, and I will do so informally, as these have been covered more extensively in my testimony.

The first issue, and it's one that Tom Lovejoy addressed in passing but I want to confront it head on, is the question of species, plant species diversity in the United States because as we have seen, there has been such a tremendous emphasis on diversity in other parts of the world that I think that a certain amount of rationalization is required to understand why this act should in fact be focused on the diversity of the United States.

There are about 25,000 kinds of plants that are native to the United States in over 1500 genera, a tremendous diversity from Arctic and alpine environment to tropical environments. Depending on which estimates of the global flora you accept, that is roughly 10 percent of the world's plant diversity. So in talking about plant diversity of the United States, it is not as if we are talking about an insignificant fraction of global diversity; it is a very sizable fraction and a significant fraction.

Now within that plant diversity that is native to the United States, somewhere between 12 and 20 percent, again depending where you draw the line, is considered to be at risk of extinction. In fact, a survey conducted by the Center for Plant Conservation that was released with the support of the Smithsonian Institution last year, found that there are close to 700 species of plants maybe within a decade or even less of extinction.

What that means is that we are facing a problem that is, to address one of the questions that was asked, both critical and extensive in nature.

Now why species? The findings of the act are careful to point out that in addition to species conservation we want to be concerned with conservation of communities and ecosystems and different levels of biological organization.

Well, I want to underscore the significance of species loss at the scale that is being faced in this country. If you consider every species to be like a brick in the foundation of a building, then the stability of that building is, to a great extent, a function of the diversity and number and variety of those bricks in the foundation.

Well, you can probably lose one or two or a half a dozen bricks of a foundation and still have a standing house, but by the time you have lost 20 percent of the species—that is, 20 percent of the bricks in that foundation—you are going to destabilize the entire structure. That is the way ecosystems work.

So there is language in sections 10 and 11 of the findings on page 4 which I would suggest are unnecessarily restrictive on the importance of conserving species diversity, and I wouldn't want to see the bill drifting in the direction of deemphasizing the importance of plant species diversity in favor of other levels of organization.

Now a second point which I just want to touch in passing is that a very large number of species which are native to the United States, are close relatives of economically important plants, major grains, vegetables, fruits, oilseeds as well as most of our major trees that produce timber and forest products, and in addition the U.S. Department of Agriculture has issued a series of reports that document the economic potential of a large amount of native plant variety.

Now I point this out not because I think members of the committee are unaware of it, because it is clear from the legislation that the committee has studied this issue, but I do want to suggest that in developing support for biological diversity legislation in the United States, the importance of the agricultural and economic importance of that diversity should not be overlooked.

There are a large number of people in this country who are only going to be persuaded to support legislation of this kind if there is some kind of clear and foreseeable economic payback.

So I do want to suggest that in conserving the plant diversity of the United States with over a thousand genera that are represented as endangered, we have there an economic resource that plant biotechnology is just beginning to open up, and it would be like burning the library just as we are learning to read and use that resource.

Mr. **Scheuer**. Can you explain to us or elaborate how these thousand plants that are facing extinction would constitute an economic resource for our country if they could be saved?

Dr. **Falk**. Sure. The first thing you need is access to the living plant material itself. And this is one of the reasons why offsite collections and managed in situ reserves are so important. You have got to be able to get your hands on the material from a research point of view. Once you have your hands on it, you need the tools to make this genetic resource usable.

There is a report that I would be glad to supply as an appendix that was released in Science magazine a couple of months ago describing some research that has been done in Utah transferring a drought-resistance characteristic from a wild strain of tomato to a cultivated tomato, using a fairly sophisticated gene mapping and gene transfer technique.

But the point here is that among native plants there are many that are adapted to alkaline soils, to saline soils, to drought, to high levels of heavy metals in the soil, and these conditions which native plants face in their natural environment are precisely the conditions which agriculture may have to contend with in the coming century if the current predictions of global warming come to pass.

So this does suggest that one of the functions of the National Center then should be in fact to join plant biotechnology, which is presently largely being developed in the private sector as well as some programs in the Agricultural Research Service, to join plant biotechnology with the conservation of diversity.

I think it's fair to say that that connection has never really been made in a substantial way before, and that is because we have always looked at diversity as something that should be protected in its own right and we have neglected the other side of the equation and therefore the other constituency, which is its economic potential.

A third point that I just want to touch on is then the strategies for conserving plant diversity, with this tremendous range of types of plants and the wide range of threats that they face.

This act has an opportunity to establish a very important precedent, and that is in what I would call an integrated conservation strategy. Now in the past, as you know, conservation strategies have generally relied either on legal protection, legal measures such as the Endangered Species Act, or on massive and large-scale land acquisition either by agencies of Federal and State Governments or by private agencies.

Well, these two steps need to continue. They are the sine qua non of any other kind of conservation. And yet there are numerous examples now of species in communities which are declining even though they are on protected land.

This suggests that there is a need to integrate, to weave together our different methods of conservation so that we may in a given case want to acquire a piece of land, pass a law that makes sure that it is protected from incidental or malicious taking, establish a cultivated protected population in a botanic garden, carry out research on seed germination in a university, and ultimately restore the habitat.

It's when you weave all those things together, that is integrated conservation. And that, I would argue, is what this kind of legislation ought to be aiming at.

The last point I would like to mention is in connection to the data. It is the importance of databases for conservation. The act correctly recognizes the importance of databases, but I think there is a potential for going astray in the approach that has been taken, and I would like to offer a comment for your suggestion.

We recognize at the Center for Plant Conservation the importance of having good data. And we have in fact an extensive database that has been developed with the Nature Conservancy and the Fish and Wildlife Service.

But the most effective way to maintain data on something as mind-bogglingly diverse as biological diversity itself is not necessarily in a single, massive, sort of Greco-Roman model, centralized database. The current generation of fast, cheap and efficient microcomputers and the ability to network between and among microcomputers suggests to us, and we would counsel the committee to consider, the possibility that enhancing the compatibility among some of the existing databases may be a more effective and cheaper way to proceed in the data area.

Now I find conservation to be a little bit sometimes like motherhood in that at some point you have to ask how much is enough. I want to suggest two areas that I have not seen addressed in the commentary on the act, although it may be part of your thinking.

But, for the record let me observe that first of all there is a much greater need than I see reflected in the present language of the act to set priorities for conservation. You can't do everything all at once. You simply can't. And I think Tom's commentary gave us an example of how we might have to make some choices. Where there are species or communities or populations or fractions of diversity that are within a few years of extinction, I would argue that those have got to be among the highest priorities. We simply can't let portions of diversity become extinct while we expend effort on other species and other communities that may not need our help so desperately.

The other aspect that I don't see represented in the act is cost effectiveness. And it surprises me somewhat, and I think it may surprise some of your colleagues when they begin to analyze the actual results of this piece of legislation.

Again the biological problem is so much greater than the combined resources we have available that I think this has got to be part of our thinking: Well, how do you build cost effectiveness into a national biological program? I think the key, and again I can only just sketch this for you here, is to look at the different levels of biological organization, species and populations and communities and ecosystems and so on, higher and higher levels of organization.

If all you need is access for the U.S. Department of Agriculture to a few genes that they are interested in and a particular variant of a sunflower, then buying that piece of land at the cost of hundreds of thousands or millions of dollars and years of effort, it would be a very inefficient way to proceed when maybe what you need to do is simply make an offsite collection of that genetic variation.

On the other hand, you can't keep ecosystems in a bottle or a seed bank or a botanic garden. The higher levels of conservation have to be accomplished on the ground. And so I would suggest that cost effectiveness is going to come about by mixing and matching, by finding the optimal mix of conservation methods. And if that is a basic part of our strategy, then I think we will be able to argue that we are using our resources most effectively.

One last comment, if I may. In section 6, paragraph (d) on page 14 of the act, establishing the governing board of the National Center, I view the governing board—in fact, all these boards but especially the governing board—as an opportunity to introduce new energy and vitality and creativity and ideas into this National Center. I would regard it as a real shame if we simply saw a reiteration of a lot of the same ideas that have been around for a long time, simply sitting in new chairs.

And I would suggest from my own admittedly biased perspective, I see inadequate representation of the nonprofit or independent sector, which is my own sector, on the governing board. I think this is a sector that has shown tremendous vitality and creativity and insight into environmental problems. And I would urge a broader role, if at all possible, on the governing board.

I appreciate the opportunity to make these comments. Thank you very much.

[The prepared statement of Dr. Falk follows:]

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Testimony of Donald Albert Falk
Executive Director
Center for Plant Conservation
Jamaica Plain, Massachusetts

To: U.S. House of Representatives, Committee on Science, Space and Technology; Subcommittee on Natural Resources, Agricultural Research and Environment

In Support of the proposed National Biological Diversity Conservation and Environmental Research Act, H.R. 1268.

17 May 1989

Mr. Chairman, I have come down to Washington today for a single purpose: to testify on behalf of H.R. 1268, the National Biological Diversity Conservation and Environmental Research Act. This is a farsighted and intelligent piece of legislation, and it deserves the full support of the Committee. I wish to take a few minutes to substantiate for you my view -- and the view of many in the conservation field -- that this is strategic legislation. I will also offer commentary on specific provisions of the Act, and to answer any questions you may have regarding its significance particularly for plant diversity. In particular I wish to address the impact of H.R. 1268 in two respects:

1. What is the plant diversity of the United States, and why should we care about it?

2. What are the emerging strategies to conserve this diversity?

1. The Extent and Significance of Biological Diversity in the U.S.
As the Committee is well aware, it is the diversity of plant species and plant communities that literally sustains life across the entire planet: by photosynthesis, by creating and maintaining topsoil, by regulating global systems of water, oxygen and carbon dioxide production and circulation, and by providing the food we eat, the clothes we wear, and directly or indirectly the energy we use and many of the materials we build with. So as a nation we have a major stake in protecting natural systems: everything is at stake, and far-reaching legislation is called for. This is well stated in to Findings of the Act.

One of the greatest problems we have faced in the past in the field of conservation is what might be termed the "so what?" factor. It has not always been easy -- in fact, for the most part, it has been exceedingly

difficult -- to raise public awareness of the critical need to protect natural systems. But we see -- and I am sure members of the committee have experienced -- a tremendous upsurge in public consciousness of our environment. The concern for global climate has changed the climate in Washington for environmental legislation. To put it simply, people are scared, and they want to see action.
There are approximately 25,000 kinds of plants native to the United States, of which 3000-5000 (12-20%) are presently at risk of extinction. To understand the significance of species loss at this scale, consider the analogy of an ecosystem to a building. Each species is like a brick in the foundation; they are the building blocks of more complex systems, and it is their particularly adapted sizes and shapes that make the structure so sound. Every time a species becomes extinct, then, is like pulling a brick out of the foundation: you can probably survive a few such losses, but by the time 12-20% of the bricks have been pulled out, the whole structure is going to become dangerously unstable. That's the way it is with ecosystems.

Because of this, I suggest that the language of Sections (10) and (11) of the Findings are unnecessarily restrictive of the importance of conserving species diversity. Complex ecosystems are built of a variety of communities, which in turn are composed of populations consisting of many species. So the point should not be to turn away from species conservation efforts, but rather to integrate such efforts with conservation at higher levels of organization.

The other consideration in protecting plant diversity is its utility to humankind. Among the endangered species of North America, there are close endangered relatives of major grains, vegetables, fruits, oil seed crops, and virtually every major type of timber used in forestry: pines, firs, spruces, maples, birches. There are endangered plums, raspberries, blueberries, squash, corn, tobacco, sunflowers, wild rice, as well as familial relatives of a wide range of other crops. Each species represents a genetic adaptation to a particular environment, and among the native plants of the U.S. there are crop relatives adapted to alkaline or acid conditions, poor soils, and drought: precisely the conditions with which American agriculture may have to contend in coming decades, if current predictions of global warming are accurate. Again, an analogy may help: consider plant diversity to be a vast library of genetic resources; do we want to bulldoze the library with all its books inside, just as biotechnology is enabling us to decode, read, and use all that information?

2. Strategies for Conservation

When Theodore Roosevelt signed into law that act creating Yellowstone National Park, he ensured the protection with a single stroke of his pen of over 2 million acres of prime wilderness. With the sole exception of the Alaska National Interest Land Conservation Act, we no longer have the opportunity in conservation to protect land on that massive scale: the country is, by and large, now too densely populated to permit such sweeping measures for land protection. But we can make a grand gesture -- in fact, it is the only feasible approach -- to recognize the living biological diversity of this nation and take steps to ensure its conservation.

Strategies for conservation must be as diverse as the nature we are trying to protect, and the threats it faces. Recognizing this, the conservation community has already undergone significant evolution in its own relation to natural systems: the basic posture has shifted from one of laissez-faire to a more active phase of biological management and stewardship. From the smallest half-acre pocket preserve to the largest national parks, we are actively managing land to ensure the perpetuation of natural diversity. Much of this management takes place on public land, such as the 47% of the land area of the United States west of the Rocky Mountains that is owned by agencies of the Federal government.

Such an approach is inherently collaborative, and is characteristic of what is increasingly called integrated conservation strategies. The essence of an integrated strategy is that for any piece of biological diversity we wish to protect -- a population, a species, a community, a whole ecosystem -- there is an optimal mixture of conservation tools and methods that will achieve the highest degree of protection. These strategies can thus be highly site-specific, tuned to the particular biology of a species and the threats it faces. For example, in the Apalachicola River basin of southern Georgia in Florida there is a species of tree, the Florida torreya, that has a wood so durable that fenceposts make with it by settlers 200 years ago are still standing free of rot in the ground. The land where torreya grows is protected, but the species is attacked by a fungus that falls the young trees before they reach reproductive age; as a result, the species is threatened with extinction. What the torreya needs -- and what many species in the U.S. need -- is a sophisticated approach to biological management. And management is information-intensive, and requires collaboration across disciplines and among agencies. That is why a unified act of national legislation is so important.

Again, I would underscore the importance of integrating our conservation strategies by employing multiple methods. In a given case we may identify a priority species through the efforts of a Heritage program, offer legal protection under the Endangered Species Act, acquire and manage the habitat through the efforts of a private organization such as The Nature Conservancy, conduct research on the rare species' biology at a botanic garden or university laboratory, and ultimately restore the community to a healthy condition by an integrated, synthetic approach. That's integrated conservation, and it is ultimately what the National Biodiversity Act should aim for.

I appreciate the opportunity to offer this testimony to the Committee, and would be happy to answer any questions you may have. Thank you.

Mr. SCHEUER. Well, thank you very much, Dr. Falk, for your very stimulating testimony.

Dr. Duckworth, please take your five or six or seven minutes, and then when you are finished we will have questions for both of you.

STATEMENT OF DR. W. DONALD DUCKWORTH, PRESIDENT AND DIRECTOR, BISHOP MUSEUM, ON BEHALF OF AMERICAN INSTITUTE OF BIOLOGICAL SCIENCES

Dr. DUCKWORTH. Thank you, Mr. Chairman.

Mr. SCHEUER. Your full statement will be printed in full at this point in the record.

Dr. DUCKWORTH. The last opportunity to appear before you was at your special hearing in Honolulu, Hawaii—is it this year or last year? Time has passed so fast. I am delighted to be here again.

Mr. SCHEUER. It was January of this year.

Dr. DUCKWORTH. January. As you remarked in January in Honolulu, it takes only a short time in that State of the Union to realize how critically urgent this legislation is. We are the heartland of extinction, endangerment, and disappearing ecosystems as the activities of both natural proportions and human proportions occur and affect our very fragile environment.

I am here today representing the American Institute of Biological Sciences, of which I am a past president, and the Association of Systematics Collections, of which I am sitting vice president. Together these two organizations represent more than 70,000 life scientists, most of whom are concerned in all ways with biodiversity, from the microbiological level to the systems level, to the ecosystem level, to the conservation biology level and so forth.

The Association for Systematics Collections represents virtually all of the institutions, freestanding museums, governmental institutions, research laboratories and so forth that hold in trust the tangible documentation of organismal biodiversity and much of the genetic and cellular biodiversity that is held in perpetuity for purposes of information and utilization both in basic research as well as in applied systems of management of all kinds.

It goes without saying that anyone who follows Tom Lovejoy, Mr. Falk and the others who will appear before you today, almost anything one says about the urgency, the importance, the short- and long-term significance of protecting, preserving, even recognizing and documenting biological diversity both in the United States as well as in the world as a whole is going to be somewhat redundant. We all know the urgency of the issue. We all have made our points.

I would simply like to say a few things about the urgency. I would like to emphasize the support of the American Institute of Biological Sciences, the ASC and, I believe, the majority of those in research and associated with research and documentation and conservation activities, our deep gratitude to you and your cosponsors on this significant legislation.

This is a difficult issue to translate into the public policy sector. If it were easy, we would have had a national biodiversity bill 20–25 years ago, and we would have been the better for it if we had. But it takes a great deal of effort to translate this large and important subject into a functional, integrative piece of public policy legislation.

We are grateful for your efforts, and we compliment and applaud your leadership.

We believe that the bill, as it is drafted, while we recognize it may have to undergo a variety of modifications as it goes through the process, we believe it a sound bill. It is not a thoughtless bill or a bill that has come about through quick reaction. It has been studied. There has been opportunity for virtually every party concerned individually and collectively to have an opportunity to contribute.

We believe that the activities of the Center, which is a centerpiece of the legislation, are most important. Virtually everyone knowledgeable of the subject recognizes that many management activities, certainly not all, but many management activities are carried forward on the basis of inadequate, imprecise, and ofttimes absolutely incorrect information regarding the organisms and the environments that are involved.

This is not because there is a lack of information on some organisms and some systems, but there is in general less information available and less information readily available than is appropriate for the decision making process that must take place today.

We are supportive of the system of a Center that brings together both the endeavor needed in basic research and documentation in creating the database. To be perfectly honest, while there is a great deal of information that exists, it is very much like the banking system: if there were no mechanism for rapidly transmitting banking information from bank to bank, State to State, agency to agency and country to country—a lot of random data poorly organized for purposes of diversity of access and an enormous job to do.

In research, we not only know a great deal exists in collections at the moment—in my own case, for example, at Bishop Museum in one of the most intensively studied groups of insects perhaps in the world, the palmas flies in Hawaii, which evolution has provided a group of organisms that is almost classic in its ability to allow us to understand and unravel evolution, has been intensively studied for 15 or 20 years now—in our collections at Bishop Museum there sit undescribed more than 200 new species of this group of flies that we simply have not had the resources and people and time and so forth to describe. That information, while partially available, is not completely available.

We know there are many more species in the Hawaiian archipelago that we have yet to discover and describe—urgently and critically needed research. Again, we support this bill in its endeavor to give us the resources to begin that process.

Finally, I would just like to say that in relation to the Center itself, it is important to get started. We can sit and debate—and we have debated both within the profession and outside the profession in the conservation world and the governmental enforcement world, we have debated issues to death. The bill has a workable definition for all the issues involved, and we need to get started. The resources—the job at hand is much greater, as has been commented already and I am sure will be commented again, much greater than the available resources called for in the bill. But we must get started.

We have resources available that need to be marshalled. We believe this bill will integrate them, and we are very supportive of it.

Mr. Chairman, thank you very much for the opportunity to come these 6000 miles and appear before you once again. Thank you.

[The prepared statement of Dr. Duckworth follows:]

AMERICAN INSTITUTE OF BIOLOGICAL SCIENCES

STATEMENT OF
W. DONALD DUCKWORTH, Ph.D.
PRESIDENT AND DIRECTOR OF THE BERNICE PAUHAI BISHOP MUSEUM
HONOLULU, HAWAII

On behalf of the American Institute of Biological Sciences
and the Association of Systematics Collections

Before the
Subcommittee on Natural Resources,
Agriculture Research and Environment
Committee on Science, Space, and Technology
United States House of Representatives

Concerning H.R. 1268
The National Biological Diversity Conservation
and Environmental Research Act

May 17, 1989

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ABSTRACT

The American Institute of Biological Sciences (AIBS) and the Association of Systematics Collections (ASC) believe that H.R. 1268, if passed in its present form, will make a unique contribution to solving the environmental crisis facing our country and indeed, the world. This bill will create a National Center for Biological Diversity that will:

1. make available the databases that are critical for protection and sustained use of biological diversity;

2. find gaps in those databases that are critical for protection and sustained use of biological diversity;

3. develop a partnership of scientists, conservation advocates, resource managers, and governmental policy makers to set priorities for management, using state-of-the-art information on systematics, ecology, and conservation biology; and

4. provide unbiased information to federal agencies working towards rational natural resource management, with the goal of maximizing biological diversity.

The Center concept is close to the concept of a "centralized, credible, non-advocacy agency, similar to the U.S. Geological Survey, to perform federal biological and environmental data collection and research for all government agencies" called for in the 1988 Blueprint for the Environment. That document was prepared by a coalition of environmental groups as policy options for the new Administration.

AIBS and ASC beleive that the best place for the center to be located is in the Smithsonian Institution, with a policy board composed of the various elements concerned with biodiversity (including users of natural products). There should be the possibility for the Center to contract out projects of high priority for inventory and preservation of biological diversity to NGOs, universities, museums, state biological surveys, and related organizations best suited to provide answers.

MR. CHAIRMAN AND MEMBERS OF THE SUBCOMMITTEE:

I am Donald Duckworth, President and Director of the Bernice Pauhai Bishop Museum in Honolulu, Hawai'i. I appreciate the opportunity to appear before you again today. The last time was at a special hearing you held in Hawai'i on conserving our native biological diversity. As you observed on your visit to Hawai'i last January, nowhere is the need for a national law for biological research and conservation of our natural resource heritage more visible. As evidence of this, I would like to submit for the record a special issue of the AIBS journal, BioScience, which focuses on "Hawai'i's Unique Biology."

Today, I speak to you on behalf of two organizations that represent a majority of our nation's scientific societies, research laboratories, institutions, and individuals who study biological diversity.

The American Institute of Biological Sciences (AIBS) is a federation of some 40 scientific societies and research laboratories representing over 70,000 life scientists across the nation. AIBS was chartered in 1947 as part of the National Academy of Sciences and became an independent organization in 1955. AIBS is dedicated to the advancement of the biological, agricultural, and medical sciences and their applications to human welfare, and to fostering and encouraging research and education in all the life sciences. As an institution, AIBS supports the conservation of biological diversity as we are both the "generators" of biodiversity information and the "users" of this data. Our 1988 annual meeting, which was attended by more than 3,600 scientists, had biological diversity as its theme.

The Association of Systematics Collections (ASC) represents the natural history museums and botanical gardens in North America. Among its 80 institutional members are the Smithsonian Institution, the state biological surveys, museums such as the Bishop Museum and New York's American Museum of Natural History, agricultural research centers, and university museums. ASC has 20 affiliate societies including the American Ornithological Society and the Entomological Society of America. ASC's book, Foundations for a National Biological Survey, brought attention to many of the issues raised in H.R. 1268, the biodiversity bill.

The members of the American Institute of Biological Sciences and the Association of Systematics Collections commend you for introducing H.R. 1268, a much needed bill that brings attention to the importance of conserving biological diversity. We respect your leadership on this important issue. H.R. 1268 is an important first step in finding solutions to the biodiversity crisis, as it establishes procedures for the federal agencies to coordinate conservation and management under federal protection, and provides needed funds for research.

THE NEEDS

The biological diversity of our planet is critical for climatic stability and provides important ecosystem services. It provides the natural resources that are the basis of human existence. It is no accident that in the history of the human species, the diversity of plants, animals, and their habitats have provided rich aesthetic enjoyment and a sense of well-being.

Biological diversity is threatened by over-exploitation of resources and by loss of habitats. Scientific criteria have not been used to set limitations on processes that degrade biological diversity. Economic calculations have failed to include costs of over-exploitation and habitat destruction.

The U.S. has a strong structure of scientific institutions, both governmental and private, that can provide data relevant to the protection and management of biological diversity. Our non-profit sector has likewise evolved diverse groups of non-governmental organizations (NGOs) that speak clearly on the need to preserve biological diversity. Federal agencies form a third element in the equation, for they have many (sometimes overlapping and even conflicting) responsibilities towards the nation's natural habitats and biota.

However, the United States needs:

1. A consolidated "knowledge base" on biological diversity, including information on species and their ranges (systematics), critical habitat needs (ecology), and management and restoration (conservation biology).
2. A way to apply scientific knowledge to natural resources policy, land management, germplasm preservation, and other issues involved with biological diversity.
3. A means to identify gaps in knowledge and provide incentive for scientists to work on these gaps.
4. Coordination of existing organizations and federal agencies to avoid duplication, and to provide an efficient means to set priorities. We need ground rules so that the necessary mutual limitations on the natural world and human activities can be set up so to maintain biodiversity for the long term.
5. American culture must become comfortable with the notion that maintaining natural ecosystems is essential for human existencet. Biodiversity is not a burden, but a resource to be husbanded.

H.R. 1268 provides the framework to meet all of these needs.

NATIONAL POLICY

The U.S. must make the conservation of biodiversity a national goal and priority in our own country. The U.S. Congress has taken a leadership role internationally in promoting the conservation of biological diversity in developing countries. Now, as stated in H.R. 1268, we will have our own national program.

States such as Hawai'i are a biological showcase for the U.S. More than 95% of Hawai'i's native species are endemic--found nowhere else-- a higher percentage than anywhere else on Earth. Hawai'i's isolation and the specialization of its organisms have also made Hawaiian biota very vulnerable. (BioScience, Vol. 38, No. 4, p. 220) Last year the subcommittee heard much about the loss of biodiversity in Hawai'i from Congressman Daniel Akaka (D-HI). Likewise, at the January subcommittee field hearing in Hawai'i, we learned first hand about the frightening loss of Hawaiian plant and animal species.

APPLYING SCIENCE TO CONSERVATION

H.R. 1268 is valuable as it creates a partnership between the scientific research community and the conservation community. Over a dozen scientific societies have passed resolutions calling for legislation like H.R. 1268. Resolutions were passed by the American Institute of Biological Sciences, the American Society of Plant Physiologists, the Association of Southeastern Biologists, the Association of Systematics Collections, the Botanical Society of America, the American Ornithologists Union, the Ecological Society of America and many others (see appendix).

The U.S. needs better precision in understanding our natural ecosystems and the species they contain. We need research to identify species and to restore ecosystems using conservation biology. The current amount of money authorized in H.R. 1268, $25 million over three years, would allow this nation to begin coordinating available information, and to embark on a national biotic survey. But to do an effective job in conserving and finding solutions to our loss, we need more money. Some of the federal funding could be used as seed money to get matching grants from states and foundations to fund specific research or applied projects. It is essential that the Center be a permanent entity that will receive continued funding in the years ahead. Because the biodiversity problem is not going to go away, and we must continue to study and manage our biotic resources.

The research segment of this bill is not idle study. Under H.R. 1268, the Center for Biological Diversity will be directed towards three goals:
1. Identification of important biological resources and habitats;
2. Better management of the nation's natural resource heritage;
3. Management of information on biological diversity and conservation biology that will allow better priorities for conservation to be set by our federal agencies.

I realize there may be questions raised on the definition of the term "biological diversity" due to the broadness it represents. However, biodiversity represents all the variety and variability within and among living organisms and ecosystems. Conserving biodiversity will mean different activities for different ecosystems, and for the different people conducting the research and management, at different times. We shouldn't waste time arguing over the definition, as it is scientifically sound and defensible (OTA Report: Technologies to Maintain Biological Diversity, March, 1987, p.3).

Federal support of research in systematics/ ecology/ conservation biology plus the input of NGOs will help define the constraints that should be placed on human activity to protect the critical biological resources needed for long-term human well-being. Conversely, knowledge of biological diversity and conservation biology will allow our nation to identify actions that might impact negatively on our biota in the short run, but will lead to long-term gains.

THE CENTER

Research and management in systematics and conservation biology in the U.S. need to be focused in the light of conservation and resource management priorities. H.R. 1268 addresses this need by establishing the National Center for Biological Diversity and Environmental Research, which will set a national agenda, and provide the context in which research and education in systematics, ecology, and conservation biology will be directly related to our national purposes.

The U.S. needs trained scientists to monitor biodiversity, to study, to classify, and to understand organisms and the interrelationships between them and their ecosystems. The development of this knowledge must be a national goal, as outlined in H.R. 1268.

The key functions of the Center for Biological Diversity created by H.R. 1268 should be to keep track of existing information and databases on biodiversity, to identify weaknesses in the available information for conservation and resource management purposes, and to contract with experts to fill those gaps through scientific research and/or the production of floras, faunas, culture collections, and keys to biota. These tangible products should also include secondary research: (1) a database of databases on biological diversity; (2) summary habitat atlases indicating critical habitat; (3) Conservation Biology Status Reports to monitor recovery; and (4) reports on sustainable yield of biological resources.

The Center should communicate information to the Council on Environmental Quality (CEQ) that will allow policy decisions. It should provide information to Federal and State agencies that will help them make informed decisions on habitat preservation, natural resources, and other conservation issues. H.R. 1268 should mandate that each federal agency appoint an appropriate staff member to be responsible for data management related to biological diversity and to communicate with the Center, to insure compatibility and continuity of databases. Thus the Center should provide a link between the scientific research community, the conservation community, and the governmental offices responsible for federal and state environmental policy. The objective reports produced by the Center should be used by the Environmental Protection Agency (EPA) for comparison with impact statements and other documents provided in support of actions by federal agencies that might impact on biological diversity.

AIBS and ASC support the placement of the Center in the Smithsonian Institution as it already has our national collections and the largest information base on U.S. biota. In Dr. Peter Raven's testimony from last year, we supported housing the Center at the Smithsonian, but with its own identifiable mission. We maintain that position for the following reasons.

The Center should be a centerpiece under one management, independent of regulatory and political processes, but still linked to the federal government. Interagency efforts tend not to work effectively due to internal rivalries about who controls the positions and the money. Likewise, each agency has a different federal mandate and procedures. It is critical that the Center be independent of any governmental agency with a stake in land management or natural resources, and a history of a particular strategy to deal with these issues.

The Smithsonian already has existing infrastructure and capabilities for survey work and databases. It is linked to a network of researchers and conservationists worldwide, and can implement the needed mechanisms for funding scientists, non-governmental organizations, state and university programs. The Center would not be an entirely new mission for the Smithsonian, but it needs to be mandated through a specific Center. The Smithsonian is linked to the U.S. agricultural programs through USDA's Systematic Entomology Laboratory, which is partially housed at the Smithsonian, and through the botany collections. H.R. 1268 provides a platform for closer collaboration with the collections and database programs of the USDA, including the germplasm database known as "GRIN."

At the Smithsonian, the National Center for Biological Diversity would have the capability of synthesizing the knowledge on which well-informed actions could be taken. It would coordinate a database about the more than 300,000 species of organisms that live within the borders of the U.S. and our territories. Such a center could provide documentation necessary for effective private and public action in conservation, natural resource use, and land-use planning.

The Smithsonian Institution is likely to welcome a strong external advisory board drawn from the broad U.S. community of users and caretakers of biological diversity for the National Biodiversity Center. It would be eager to cooperate with other organizations in national survey work including the Nature Conservancy, state natural area programs, state biotic surveys, heritage programs, in addition to international work. The Smithsonian cannot do all that is required alone, but is well-suited to be the central focus of a national plan.

As for the administration of the Center, the advisory board should meet regularly to review the priorities of the Director of the Center. It should review the letting of outside research contracts, and should insure that the topics of those contracts are consistent with the mission of the center to promote research on biological diversity and conservation. The board should be composed of: (1) natural history researcher, most probably from the university community; (2) representatives of institutions with large reference collections in natural history and their attendant databases; (3) a representative of one of the state biological surveys; (4) representatives of users of natural resources (e.g. the agriculture community); and (5) at least one member of a private conservation organization. The board should not contain more than 11 members.

FEDERAL AGENCIES

Federal agencies need a mandate to conserve the biotic diversity of our national lands. And agencies, especially those with multi-use mandates, must ensure that their programs do not contribute to loss of biodiversity on non-federal lands.

Setting federal land aside by agencies is not enough. We need active management and enforcement to prevent the continued loss of biodiversity. For example, the U.S. Fish and Wildlife Service must build fences around the Hakalau Forest National Wildlife Refuge on the slopes of Mauna Kea to protect the habitat of many wildlife species including five endangered bird species. Fences prevent the habitat from being destroyed by non-native pigs and goats. Likewise the invasion by exotic plants must also be controlled and damaged habitat needs to be restored.

We need a cooperative federal effort in conserving our national biological diversity. Federal agencies must work together using an ecosystem approach toward conservation; Hawai'i is a prime example. Currently there are more than 50 units of land with conservation status in the state of Hawai'i. This includes, military reserves, state areas, Nature Conservancy preserves, 14 national wildlife refuges, and two national parks: Haleakala on the Maui and Hawaiian Volcanoes on the island of Hawai'i. (Both of the national parks have been designated as biosphere reserves in the UNESCO's Man and the Biosphere program.) To preserve the unique island ecosystems of the Hawai'i, the federal agencies must manage cooperatively.

CONCLUSION

In conclusion, AIBS and ASC strongly support H.R. 1268. The legislation makes the conservation of biological diversity a national priority, and would coordinate federal efforts to protect U.S. national resource heritage. It provides a mechanism to conduct scientific research to base conservation actions. The types of needed efforts include basic research, collections data, natural resource husbandry and management, as well as culture collections. Finally, we support placing the National Center for Biological Diversity at the Smithsonian where it could have a strong advisory board. This will allow it to be a centerpiece and example to other nations.

Thank you for the opportunity to show AIBS and ASC's support for the National Biological Diversity Conservation and Environmental Research Act (H.R. 1268). I will be pleased to respond to any questions you or other subcommittee members may have.

APPENDIX

SCIENTIFIC SOCIETIES THAT HAVE PASSED RESOLUTIONS SUPPORTING NATIONAL LEGISLATION TO CONSERVE BIOLOGICAL DIVERSITY

American Fern Society
American Institute of Biological Sciences
American Ornithologists Union
American Pharmaceutical Association
American Society of Mammalogists
American Society of Pharmacognosy
American Society of Plant Physiologists
American Society of Plant Taxonomists
American Society of Zoologists
Animal Behavior Society
Association of Field Ornithologists
Association of Southeastern Biologists
Association of Systematics Collections
Botanical Society of America
Cooper Ornithological Society
Ecological Society of American
Wilson Ornithological Society

Mr. SCHEUER. Well, thank you very much, Dr. Duckworth. We appreciate your support and your analysis of the bill. If you have any further thoughts on cost effectiveness and how that can be cranked into the bill, by all means let us know. I will have a chance to ask you this in another few minutes.

Right now I am going to yield to my ranking minority colleague, Claudine Schneider of Rhode Island.

Ms. SCHNEIDER. Thank you, Mr. Chairman.

Mr. Falk, I congratulate you for your very insightful testimony. I will say that it is one of the best pieces of testimony that I have ever heard before this committee. And let me say that your constructive criticism or suggestions fell on attentive ears.

I for one in my own global-warming bill have been very adamant and the single most significant piece of that legislation is that it does a cost-benefit analysis. And in essence that is what you are suggesting that we do in this legislation too.

I think that the need to set priorities is critical, however, and I think this is where we as policy makers need more guidance. I think that if we can give the directives in the legislation to say that priorities must be set, do you suppose that should be adequate? I mean I don't feel comfortable in having us set the priorities.

Mr. FALK. No. And I don't think we could get ahead of ourselves in trying to state in the bill or even in the supporting documentation of the bill what those priorities are. That has got to be clearly stated as among the first tasks of the Center and of the other programs that happen if and when the act is passed.

Ms. SCHNEIDER. The other comment that you made having to do with the governing board I also wholeheartedly welcome. I feel that our constituency so often says why doesn't Government move more quickly. It clearly is because we have some of the same players in the driver's seat all the time, and I think that your recommendation is a very good one, and I would hope that you would work with us closely after the passage of this bill so that we could identify those movers and shakers so that we get going because every witness so far has clearly said that this is an urgent issue; and I think that if it is so urgent, then what are we waiting for? Let's get moving.

Mr. FALK. Yes.

Ms. SCHNEIDER. And that leads me to my next question of Dr. Duckworth.

We need to get moving on this legislation. You know, we passed it before our subcommittee last year. The full committee did not take it up because they didn't feel, perhaps, that it was urgent enough. And the Merchant Marine and Fisheries Committee, which I also serve on, has jurisdiction over this legislation also. And we are not moving rapidly enough there either.

So clearly it takes more than the very astute leadership of Congressman Scheuer or Chairman Scheuer and myself to try to push this through because legislators are followers, and if the constituency is banging at the door saying we want action on this, then we will see some action.

But to this point, despite the fact that we have 121 sponsors, I would like to seek your cooperation actively in moving this.

And, Dr. Duckworth, you are the one that said you have 70,000 life scientists that were much committed to seeing this legislation moved into action. And I for one would like to work with you on a strategy so that we can get the scientific community more involved.

It has been one of my greatest pet peeves on this committee: that I think the scientists are the worst lobbyists in the world, and I think we should all be very grateful for some of the other witnesses we will be hearing from later—the Defenders of Wildlife and other interest groups—who really do a lot of that work for the scientific community.

But we can't wait.

Dr. **Duckworth**. I agree.

Ms. **Schneider**. I think that we do need to involve more.

I think that that is probably the extent of my questions for right now, Mr. Chairman. Are we going to run over for a vote?

Mr. **Scheuer**. Yes. That is the second bell, and we will have to go and vote.

Rather than keep you here, I would ask your indulgence. Can I have your attention a moment because we have to run for a rollcall. But if we could ask you to wait over 12 or 15 minutes, or I can give you the remainder of my questions by mail. If that would be an okay alternative for you, why don't we release you and thank you very much for your fine testimony. And we will be in touch with you by phone and by letter.

Dr. **Falk**. Thank you.

Dr. **Duckworth**. Fine. Thank you, Mr. Chairman.

Mr. **Scheuer**. This panel is finished, this most excellent panel. And we will suspend for about 12 to 15 minutes to answer this rollcall.

Thank you.

[Recess.]

Mr. **Scheuer**. All right. The subcommittee will come to order, and we will move on to panel number two.

Dr. Peter R. Jutro, acting director, marine, freshwater, modeling and global change research program of the EPA; Dr. George Leonard, associate chief of the Forest Service, Department of Agriculture; Dr. J. Doug Buffington, deputy regional director for research of the Fish and Wildlife Service of the Department of the Interior.

We are delighted to have you all today. I would ask each of you to chat with us informally for about five minutes, liberating yourself, if possible, from the printed page and just relaxing and sharing your insights and views with us.

Your prepared testimony will be printed in full at the point in the record in which you testify. And I would urge you not to hesitate in referring or commenting on anything that you have heard today either from the witness table or from my colleagues on this side of the table.

Having said that, Dr. Jutro, why don't you take five or six minutes and chat with us, and then we will go on with the other members of the panel.

STATEMENT OF DR. PETER R. JUTRO, ACTING DIRECTOR, MARINE, FRESHWATER, MODELING AND GLOBAL CHANGE RESEARCH, ENVIRONMENTAL PROTECTION AGENCY

Dr. JUTRO. Good afternoon, Mr. Chairman. I am Peter Jutro. I am acting director of marine, freshwater, modeling and global change research within EPA's office of research and development. I appreciate the opportunity to discuss our views on H.R. 1268, the National Biological Diversity Conservation and Environmental Research Act and on biodiversity in general.

In my written testimony I hope to accomplish three major purposes: I reviewed the status of biodiversity as an issue; I outlined what EPA is doing regarding biodiversity; and I expressed our enthusiasm and support for the goal of biodiversity conservation.

As you say, I would like to submit that testimony for the record and simply summarize it here very briefly.

Given your work in this area, and following the previous testimony, clearly I needn't tell this committee about the importance of biodiversity and its importance to our health and welfare. What I would like to do is summarize a few things that EPA has been doing in the area of biodiversity to familiarize you with them.

EPA recently prepared a draft report that you have seen on the effects of climate change, and a chapter of that report dealt fairly extensively with the implications of climate change on biodiversity. EPA cofunded and helped plan the National Symposium on Biodiversity sponsored by the World Wildlife Fund and the Smithsonian Institution at the National Zoo last fall.

We currently have under way a biodiversity project at our environmental research laboratory in Corvallis, Oregon. Its function is to assess the effects of climate change and of land use and pollution and other stressors on biodiversity.

We are currently preparing to implement the Environmental Monitoring and Assessment Program, or EMAP, which will determine the distribution of species and habitats, detect changes, and attempt to provide a statistically rigorous design for long-term biological monitoring. It will provide data to evaluate the effectiveness of coping strategies, and it should provide a vehicle for reporting the status and trends and changes in ecosystems.

EMAP will deal with a number of stresses, and it won't only deal with biodiversity, and it will be done in collaboration with a number of other Federal agencies.

EPA is also working through the State Department with the United Nations Environmental Program and the International Union for the Conservation of Nature (IUCN) on the development of an international convention on biodiversity. And as we speak, the governing council of UNEP is meeting in Nairobi, and we expect a decision on that convention within the next few days.

EPA has taken the responsibility for coordination of the work on biodiversity under the Intergovernment Panel for Climate Change. And we also now participate in the Keystone National Policy Dialogue on Biodiversity, which is a consensus-building group that represents Government, academia, and the private sector.

In summary, biodiversity, I should say, is a worrisome and important issue to EPA. EPA is responsible for regional environmental issues in general, and is not bound to any immediate or particular resource issues. We view our mandate in biodiversity as a strong one, and we also recognize that we have some existing vehicles to deal with the issue. Among these are NEPA and section 309 of the Clean Air Act. And we also work with resource agencies on a large number of other environmental problems.

EPA shares with the subcommittee a desire to emphasize biodiversity issues and to give them the visibility and accord them the status they deserve. We think EPA brings to the issue substantial experience with the interrelationships among scientific research and policy outcomes in the related areas of ecology and environmental protection. I would like to stress again that EPA supports the critical societal and scientific goals of biodiversity conservation.

This concludes my formal statement. I would be pleased to answer any questions that you or other members of the subcommittee have regarding our views on this bill.

[The prepared statement of Dr. Jutro follows:]

STATEMENT OF
DR. PETER R. JUTRO
ACTING DIRECTOR OF
MARINE, FRESHWATER, MODELING, AND GLOBAL CHANGE RESEARCH
OFFICE OF RESEARCH AND DEVELOPMENT
U.S ENVIRONMENTAL PROTECTION AGENCY
BEFORE THE
SUBCOMMITTEE ON NATURAL RESOURCES,
AGRICULTURE RESEARCH AND ENVIRONMENT
COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY
U.S. HOUSE OF REPRESENTATIVES

MAY 17, 1989

Mr. Chairman and members of the Subcommittee, I am Peter R. Jutro, Acting Director of Marine, Freshwater, Modeling, and Global Change Research within EPA's Office of Research and Development. I appreciate this opportunity to discuss EPA's views on H.R. 1268, the National Biological Diversity Conservation and Environmental Research Act, and on biodiversity in general.

In this testimony, I would like to accomplish three major purposes. I shall review the status of the biodiversity issue, briefly outline what EPA is doing regarding biodiversity, and express our enthusiasm and support for the goal of biodiversity conservation.

Biodiversity encompasses the variety of life at all levels of biological organization. Three primary levels have been emphasized in recent scientific thought: (1) genetic diversity: the diversity of genetic material within species; (2) species diversity: the diversity of species within a given area; and (3) ecosystem diversity: the diversity of ecosystems or habitats in a landscape. Thus, biodiversity is not merely a matter of counting species. In its basic sense, it alludes to the multiple relationships among species and environments that provide the milieu within which all living systems function.

Just as important as these contrasting aspects of biodiversity are the geological, climatological, and ecological processes that sustain and maintain biodiversity. A comprehensive approach to conservation of biodiversity, therefore, must address multiple patterns and processes in nature.

The value of biodiversity to the human race and its environment has many facets, both quantitative and qualitative. These values can be roughly grouped into four categories. First, the market values from products derived from natural sources, such as medicines, crops and industrial products, second, the value created by the maintenance of ecosystems at various levels-that is, the intrinsic complexity of natural systems is directly related to biodiversity: third, the value we realize from the cultural, recreational, and esthetics aspects of nature; fourth, that value represented by existence value, intergenerational equity, and ethical considerations, including religious convictions. These merit a brief introduction, to place them in perspective with the largely scientific discussion upon which I will then focus.

We derive a large, quantifiable benefit from those products that we derive from nature. For example, plants, fish, and game are a significant food source for many human populations. Most cultures are either fully or somewhat dependent on fuelwood, timber, and/or fiber from wild plants. Medicines derived from plants and animals are still essential in every culture. In Western countries, about 39% of prescription pharmaceuticals are now derived from natural sources, and the potential exists for many more. A generation ago, pharmacological utility depended upon plant or animal extracts. Now, even with the strides that have been made in biochemistry and genetic engineering, we are still and will continue to be dependent upon the availability of both plants themselves and genetic material from wild sources.

In addition, values associated with the environment, including such important processes as maintenance of air and water quality, watershed protection, and soil formation, depend on natural patterns and processes associated with biodiversity. Diverse genetic material within wild species allows for future adaptive change, and provides the potential for genetic enrichment of domestic crops and livestock.

The irretrievable loss of potential associated with extinction of species is the basic issue that underlies concerns about biodiversity. Today, an accelerating loss of genetic materials, as populations, species, and even entire ecosystems are destroyed, brings home this message in an unmistakable form.

The finality of species extinction must remain foremost in our minds as we discuss biodiversity. Unlike other major global issues with which we are now grappling, such as stratospheric ozone depletion and global climate change, the loss of biodiversity is not reversible: once a species becomes extinct, we and future generations are forever foreclosed from the real and potential benefits that could be realized from that species.

The impact of this finality can be imagined through a few examples. How many children or victims of Hodgkin's disease would have died from leukemia if the rosy periwinkle, the source of an anti-cancer drug, had become extinct before this use was discovered? What would have happened to the American corn crop if genetic material from wild species had not been available to stop the corn blight that began attacking crops in the early 1970's? Medical researchers may recently have found the first drug that seems to kill only those cells in the immune system that harbor the AIDS virus. That drug is derived from the root of a Chinese cucumber plant. Other examples abound. When we lose species, we lose potential sources of food, medicines, and other products, as well as making our environment less rich.

The potential for massive species extinction is recognized by biologists as an important issue today. Largely due to habitat destruction, extinction rates are now believed to be some 1,000 to 10,000 times faster than the rate one can deduce from geological history. Thus, a mass extinction episode such as we appear to be facing differs clearly from the usual dynamics of species extinction and replacement, and may even exceed in magnitude and severity some of the rare catastrophic waves of extinction of which we are aware from the fossil record.

Besides habitat disruption, other threats to maintenance of biodiversity include pollution and climate change. For these, as with habitat destruction, there is no dispute that the prime cause is human activity, including the explosion of human populations.

In the past, we have been accustomed to thinking that pollution effects were local or regional issues. With the advent of global changes in atmospheric composition, we now must learn to think of something like global pollution effects, one of which is climate change. This is as important an issue for biodiversity as it is for other concerns.

If the global warming does materialize, as some in the scientific community expect, its importance for biodiversity is at least two-fold. First, this rate of climatic change is thought to exceed that of earlier climatic changes. As an illustrative example, the change from ice-age to interglacial periods took millennia, whereas scientists believe that the changes associated with global warming will take but a matter of decades. You will note that this anticipated rate of change of climate coincides with the change in the rate of loss of species. Both are thought likely to take place over the next few decades. Second, but related to the rate of change, is to note that changing climates are but one more stress on biota in particular ecosystems. In the past, many biota merely migrated with fluctuating climates. With a rapid rate of change, many species simply cannot keep up; forest canopy communities are especially likely to collapse under these circumstances. Furthermore, the corridors along which species might otherwise migrate have been or are being eradicated by human activity. Large scale agriculture and forestry, cities, reservoirs, suburbs and similar barriers built by man are ubiquitous. Consequently, climatic change can only exacerbate the species loss that is associated with habitat destruction and fragmentation.

As an Agency, EPA has both been aware of this problem and has attempted to improve our understanding of its nature, causes and consequences. EPA already has taken significant steps to determine the current status and distribution of elements of biodiversity, and to assess the risks to biodiversity related to factors such as habitat modification and global warming. A chapter on the implications for biodiversity was included in EPA's recent report to Congress on the effects of climate change. EPA cofunded a national symposium on climate change and biodiversity held last fall in Washington. Biodiversity is one of the key areas of concern in our assessment of global climate change.

Furthermore, EPA has initiated a biodiversity project at our Environmental Research Laboratory in Corvallis, Oregon, designed to assess the effects of climate change, land-use, pollution, and other stressors on biodiversity. The biodiversity project currently is collecting information on centers of species richness and endemism, concentrations of threatened and endangered species, and locations of protected areas, in the United States and the neotropics. The specific tasks of the biodiversity project, as refined during a recent EPA-sponsored workshop, are to:

(1) Identify and map areas of concentrated biodiversity (species richness, endemism, threatened and endangered species) nationally and internationally.

(2) Identify major stressors impacting biodiversity, and map the magnitude of current and potential impact, by region.

(3) Overlay information on biological significance and degree of impact, and to identify regions at high risk.

(4) Determine effects of specific stressors on biodiversity in selected case-study regions at high risk.

(5) Evaluate alternative regulatory, management, and policy measures to mitigate effects of anthropogenic stressors on biodiversity.

EPA staff is in the process of developing cooperative projects with other federal agencies, and with private groups such as The Nature Conservancy, to fulfill the Agency's research goals.

In addition, another planned EPA program is to undertake a nationally coordinated effort to collect, synthesize, and disseminate data on the distribution, status, and characteristics of biodiversity as a resource. This interagency program currently being planned by EPA for implementation in 1990, is the Environmental Monitoring and Assessment Program (EMAP). EMAP is being developed to determine the status and trends in the condition of our nation's ecological resources, including biodiversity.

The objectives of EMAP are to: (1) determine distribution of species and habitats, on regional scales, using remote sensing and biological surveys; (2) detect changes in species distribution that might indicate an adverse change in biodiversity or the condition of the resource; (3) provide a statistically rigorous design for long term monitoring of biodiversity; (4) provide data that, over the long term, can be used to evaluate the effectiveness of our efforts to preserve species diversity and distribution; and (5) provide a vehicle for regularly reporting status, trends, and changes in biodiversity on regional and national scales.

Pollutant stress, physical habitat alteration, and measures of condition other than biodiversity will be included in EMAP. So designed, we believe the Program will provide an excellent data base for assessing not only the magnitude, extent, and location of changes in diversity, but also the associated stresses potentially causing the changes and system response to those changes, as measured by other ecosystem condition indicators.

At the international level, the United Nations Environment Program (UNEP), in cooperation with the International Union for the Conservation of Nature (IUCN), is considering the development of a new international convention on biological diversity. A decision on whether to proceed with such an initiative is expected to be made at the UNEP Governing Council this month in Nairobi. EPA has taken an active part in the State Department-led *interagency discussions on an international convention.* We expect that the recent domestic activities I have discussed can play an important part in the international community's consideration of this topic. EPA is also coordinating the preparation of the assessment of the worldwide impact of climate change on biodiversity for the Intergovernmental Panel on Climate Change (IPCC).

Clearly, EPA has a strong interest in and concern for the issue of biodiversity. Some existing legislation, such as NEPA, addresses biodiversity issues as part of the over all assessment of environmental impacts, thus providing a vehicle through which EPA can act. EPA has used NEPA and Section 309 of the Clean Air Act review processes to address biodiversity issues related to federal actions affecting wetlands and National Forests. Although other federal agencies are charged with the management of land and specific resources, EPA's mandate on biodiversity may be broader than that of other agencies. For example, whereas land management agencies are charged with responsibility for specific tracts of land, EPA is charged with responsibility for regional environmental issues, such as air quality. Thus, being removed from immediate resource issues, EPA is unlikely to face the resource conflicts faced by agencies responsible for forest products, oil and gas, and similar resources.

EPA shares with the Subcommittee a desire to emphasize biodiversity issues to give them visibility and accord them the status they deserve. EPA brings to the issue its substantial experience with the interrelationships among scientific research and policy outcomes in the related areas of ecology and environmental protection.

While EPA supports the goals of biodiversity conservation, we believe that this legislative proposal is premature at the present time.

This concludes my formal statement. I would be pleased to answer any questions that you or members of the Subcommittee have regarding EPA's views on biodiversity and H.R. 1268.

Mr. **Scheuer**. Dr. Jutro, apparently in your statement you opined to us that you thought this bill was somewhat premature. Can you elaborate on that?

Dr. **Jutro**. Well, it's an awkward question. I can address that. The problem is that Administrator William Reilly will clearly be a major force in environmental issues in this administration.

Mr. **Scheuer**. Well, we hope he will. We certainly hope he will.

Dr. **Jutro**. He is still new, and he is facing a large number of substantial issues. And neither he nor Hank Habicht, who I believe was in the process of being confirmed today as the Deputy Administrator of the Agency, have had the opportunity to review and evaluate this bill in detail. So it is simply premature for EPA to comment on the details of the bill at this time.

Mr. **Scheuer**. Well, now, look, Mr. Jutro, this bill is not all that complicated. Mr. Bill Reilly, Administrator Reilly, has an enormous knowledge in depth of this field. It seems to me that it would take him a day or two to read this very simple, uncomplicated, forthright bill, perhaps call in a few of his friends from his prior incarnation, and arrive at a very seasoned judgment as to whether this bill is a thoughtful, well-designed bill or it isn't.

He has been in office four or five months. I have enormous respect for his talents and his knowledge and his dedication. I hope that you will talk with him and get a hunk of his time and sit down and discuss this bill with him with some of your colleagues over there and perhaps encourage him to reach out into the science community where he has numerous friends and colleagues, and come to some decision about this bill.

Dr. **Jutro**. I genuinely look forward to that opportunity, Mr. Chairman.

Mr. **Scheuer**. Okay. Now what is your personal scientific opinion concerning the advisability or indeed the necessity, the urgency, the urgent necessity of moving forward on this legislation?

Dr. **Jutro**. In my personal opinion as a scientist, there are elements of the legislation that I find very important and compelling. It seems clear that there is a scientific need to set priorities for conservation, to have a framework within which to relate policy issues to scientific ones. There is a need, always a need in Government, for greater coordination. There is clearly a need for a better understanding of natural systems and a need to develop better ameliorative techniques in this area and a way to implement them both scientifically and in terms of the social and policy questions that they represent.

I think it's also important to recognize that biodiversity is a problem that won't always be addressed alone. It is a component in evaluating a large number of other issues, among them global warming, ozone depletion, and the vast plethora of pollution control legislation, let alone things that are not normally thought of in traditional environmental terms—policies on urbanization, any one of a number of other things like that.

The question isn't so much one, it seems to me, one of whether or not the existing authorities are currently there scientifically. The fact is that as a scientist, I have seen in the past that things get done when they have an organization behind them that pushes them. And it seems to me that your legislation may in fact create a situation that would facilitate that and serve the ends that you foresee.

Mr. **Scheuer**. Well, thank you very much. That is a very forthright and foursquare statement. If you have any reservations about—look, I take that to be a very thoughtful and very considered statement of sort of general endorsement of the bill. Now I don't want to press you on it, but I do want to press you to say that if you have any reservation about any aspect of the bill, if you would like to tinker with some of the details, this bill is not written in concrete. These hearings have a purpose. We want to hear from you and we are quite prepared to act on your suggestions and this bill is quite capable of being massaged in response to your views and any considerations you want to give us that we may not have thought of before.

So when we get through with the other two witnesses, I am going to ask you do you have any advice as to how this bill can be improved. We have great regard for you and the fine record of your agency in recent months, and we want to hear from you as to whether this bill can be improved.

And we thank you very much for your testimony.

Dr. **Jutro**. Thank you, Mr. Chairman.

Mr. **Scheuer**. All right.

Now we will hear from Dr. George Leonard, associate chief of the Forest Service, Department of Agriculture.

Please take five or six minutes, Dr. Leonard, to chat with us informally if you can, and don't hesitate to refer to anything you have heard here today.

STATEMENT OF GEORGE M. LEONARD, ASSOCIATE CHIEF, FOREST SERVICE, DEPARTMENT OF AGRICULTURE

Mr. **Leonard**. Thank you, Thank you.

I need to correct for the record my academic credentials. While I have over 30 years of experience in natural resource management, I do not have a doctorate.

Mr. **Scheuer**. Well, I don't either. So we are right on a level playing field on that.

We are delighted to have you.

Mr. **Leonard**. Thank you.

Mr. Chairman, you have heard some very articulate and elegant statements on the desirability and necessity of maintaining biological diversity in this country. There is no question that as a Nation we need to provide greater attention to understanding and to mitigating the effects of our programs and our actions on the diversity of plants and animals and on the functioning of ecosystems.

Aldo Leopold, an early Forest Service employee and the father of wildlife management in this country, is credited with saying that a thing is right only when it tends to preserve the integrity, stability and beauty of the community. And he defined community as including soil, water, flora and fauna, and people.

This philosophy is incorporated, in a broad sense, in the statutory charter for the management of the national forests, and it is a strongly held value of Forest Service men and women. While we understand and strongly support the need for addressing the issue of biological diversity, we have some concerns about H.R. 1268, and I would like to tell you about those.

The Forest Service already has a statutory obligation to provide for diversity of plant and animal communities based on the suitability and capability of specific tracts of land in order to meet our multiple-use charter. In order to fulfill this obligation, we are providing for diversity and developing land management plans for each national forest, and we are also shifting the focus of much of our research programs from dealing with individual species and individual problems to trying to understand the functioning of ecosystems and the management of activities within the context of those ecosystems.

Our understanding of landscape ecology, restoration management, conservation biology, and the conservation of genetic resources is growing rapidly. We believe that we are operating most of our programs very close to the state of the art in these sciences.

In order to share our knowledge and ensure that we know what others are doing and thinking, we have been sponsoring a series of regional workshops around the country. The Forest Service has been the lead agency in convening an 18-month dialogue on biological diversity at the Keystone Institute, as was just referred to. This dialogue is seeking consensus on management activities, coordination among jurisdictions and other on-the-ground aspects of biological diversity. We believe the report of these dialogues would be a very helpful tool for the Congress in shaping appropriate Federal policies.

The Forest Service is also planning a major national symposium on biological diversity in 1991.

Our experience with the general policy direction on biological diversity in the National Forest Management Acts leads us to believe that if the broad national goal of protection of biological diversity, as set forth in section 3, is viewed as a substantive requirement for the carrying on of our programs, that it will serve to confuse and delay program implementation.

The discussion between Congressman Price and Dr. Lovejoy as they developed the thought, "Do the Federal agents have the expertise to implement that requirement and the environmental impact statement process relative to the thing," I think is right on point. As Dr. Lovejoy responded, it depends on the level within the biological communities and things that you talk about.

Our biological communities are infinitely complex and we don't understand many of those functionings, and we think it would be very important for the Congress, if it passes this bill, to be explicit in terms of the level of analysis, in terms of the level of understanding that is expected of the Federal agencies in doing their job.

A requirement that we simply describe the environmental impacts or the impacts on biological diversity, absent some guidance as to the level which is expected, would simply open us up to continued challenge that, "You haven't gone far enough."

And it is absolutely true that you can always identify something that we don't know and therefore haven't discussed adequately or which in carrying out a program we won't have an understanding of what we're doing with regard to that element of biological diversity.

So I think addressing that question of the level within the biological systems that needs to be considered would be important to ensure that this is a bill that meets its objectives and doesn't serve simply as a tool for people who want to stop Federal programs.

Regarding workshops that the Forest Service is conducting, the Keystone dialogues will provide some valuable data for this committee. And therefore we share the view that was expressed by EPA that until we can address some of those issues, perhaps this legislation would be premature.

In any event, the Forest Service is committed within the current state of knowledge to maintaining the biological diversity on those areas for which we are responsible, and to that extent we support the concepts that are woven into this legislation.

[The prepared statement of Mr. Leonard follows:]

STATEMENT OF
GEORGE M. LEONARD, ASSOCIATE CHIEF
FOREST SERVICE
UNITED STATES DEPARTMENT OF AGRICULTURE

Before the
Subcommittee on Natural Resources, Agriculture Research and Environment
Committee on Science, Space, and Technology
United States House of Representatives

Concerning H.R. 1268
"National Biological Diversity Conservation and Environmental Research Act"

May 17, 1989

MR. CHAIRMAN AND MEMBERS OF THE SUBCOMMITTEE:

We are pleased to have this opportunity to testify on H.R. 1268. Conservation of biological diversity is fundamental to both environmental health and the sustainability of natural resources for people. Therefore, we are pleased to see the attention to and concern for biological diversity. However, we can not support the enactment of H.R. 1268.

Sharing knowledge and experience among Federal agencies is key to coordinating a national strategy for conserving biological diversity. Therefore, some mechanism for coordinating inventories, research, planning, assessment methods, and monitoring is warranted. However, creation of new bureaucratic entities, as envisioned in the National Center and the National Scientific Advisory Committee, would only add to the burden of bureaucratic complexity and diffuse accountability for results. Oversight from an executive agency not directly involved with management of land, water, or biotic resources--such as the

President's Council on Environmental Quality--may offer a suitable approach to coordination.

The Forest Service, along with other Federal agencies and interest groups are currently participating in the Keystone National Policy Dialogue on Biological Diversity. This consensus-building process involves approximately 50 participants from the diverse groups involved in the biological diversity issue. Keystone discussions are addressing definitions, specific objectives, priorities, and roles for major Federal agencies. The Keystone project will produce a report, by Fall 1990, that will describe areas of consensus and identify recommendations for policy action. This Policy Dialogue and subsequent report should be helpful to the Committee in considering possible legislation. We recommend that the Committee consider the results of this Dialogue prior to final action on legislation such as H.R. 1268.

The National Forest Management Act of 1976 requires the Forest Service to "provide for diversity of plant and animal communities based on the suitability and capability of the specific land area in order to meet overall multiple-use objectives." We are working to ensure that our policies on biological diversity are clearly understood and consistent with legal requirements and the current level of scientific knowledge. As you know, the concept of biological diversity is still undergoing scientific evolution, and remains somewhat elusive. The scientific community needs to work with resource managers who can help develop reasonable and prudent approaches to conservation. Encouragement of cooperative research, technology development, and conservation-applications projects are more appropriate at this time than attempting regulatory efforts.

The Forest Service has many activities underway to meet our responsibility to conserve biological diversity. These include completion of Forest Plans under the National Forest Management Act of 1976. Each Plan identifies specific standards and objectives for important aspects of biological diversity, such as recovery of endangered species, viability of existing native and non-native vertebrate species populations, genetic resources management, protection of rare or unique ecosystems, and sustainable development of natural resources.

The Forest Service is also carrying out a series of nine regional workshops on biological diversity to enable all interested and affected parties to share concerns, perspectives, and knowledge on conservation approaches. These workshops will culminate in a major national symposium on the conservation of biological diversity in fiscal year 1991.

Research projects are being revised and augmented to strengthen our scientific knowledge base in landscape ecology, restoration management, conservation biology, and conservation of genetic resources. Our work in the area of international forestry is expanding to encompass planning for the conservation of biological diversity.

Finally, our State and Private Forestry program contributes to the conservation of biological diversity on private forest lands by promoting responsible land stewardship and healthy forests.

I would like to mention two examples of practical problems that could occur if H.R. 1268 were enacted.

The first concerns Section 5(c). That section would require that "the actions, policies, and programs of all Federal agencies shall be consistent with the goal of conservation of biological diversity, to the maximum extent practicable." Biological diversity is a broad concept that must be approached through specific actions for specific objectives that may be unique to particular ecosystems in specific areas over specific time periods. These specific objectives must be built into interdisciplinary plans and actions, and coordinated among all responsible agencies and interest groups at regional and local levels.

It would be impractical to implement a national goal such as that in section 5(c), with a definition as broad as that in section 3. To be effective, a national goal or strategy for biological diversity must be translated into specific objectives, then woven into the fabric of agency missions and legal authorities. Simply overlaying a broad national goal for biological diversity across existing programs would only serve to further confuse and complicate those programs.

The second example deals with sections 5(d) and 5(g) which would amend the National Environmental Policy Act to require that all environmental impact statements include an assessment of the "impacts on biological diversity" and that the "Environmental Protection Agency shall review and comment in writing on the adequacy of each environmental impact statement."

The Forest Service currently addresses many aspects of biological diversity in our environmental assessments and impact statements. Yet, if H.R. 1268 were enacted, we foresee widespread challenges to the adequacy of our NEPA documents regarding biological diversity, because the H.R. 1268 definition is so broad. Based on experience, we anticipate that those who oppose specific Federal projects for any reason would cite failure to address some aspect of biological diversity as the reason to delay or halt those projects. This would cause unnecessary and unacceptable delays in public programs and projects. The Environmental Protection Agency would given an expanded role in overseeing Federal agency programs regarding biological diversity. It would be impratical and unrealistic for EPA to be required to review some 150 environmental impact statements annually.

While we support further discussion on a national policy for the conservation of biological diversity, we believe H.R. 1268 is premature and would not achieve its intended purpose. We strongly oppose the proposal to establish an independent National Center for Biological Diversity and Conservation Research (Section 6). We believe many of the proposed functions of the Center could be effectively carried out with less expense under existing authorities.

In summary, Mr. Chairman, we oppose enactment of H.R. 1268 in its current form, because many goals of the bill are already being met under existing authority. We believe the bill would create unnecessary, duplicative, and expensive coordinating mechanisms, and would likely subject the NEPA process to additional appeals and litigation. We urge that the Congress defer final action on legislation such as H.R. 1268 until the Keystone report is available.

I will be happy to respond to your questions.

Mr. **Scheuer**. I appreciate your candid and forthright statement. It is very helpful to us.

I hope that we will have some ongoing dialogue with you as to the level and the specificity of knowledge and detail that you think ought to be required.

You know, this subcommittee has had very painful experience with the philosophy that you have to know everything before you can do anything.

Mr. **Leonard**. We absolutely agree with that.

Mr. **Scheuer**. And I don't want any of us to get into that pickle. Now for the last eight or nine years on the subject of acid rain, which comes under the jurisdiction of this subcommittee, we have been hearing from administration sources that we can't do anything about acid rain because we don't know enough. And we have had enormous increases in our research budget for acid rain, but an adamant refusal on the part of the administration preceding this one to deal with acid rain.

They were aided and abetted by two well-known committee chairmen who represented States and districts where the business of regulating acid rain was viewed as very threatening to them. So you had an anomalous situation where the administration didn't want to move and these two influential and powerful Members of the House and Senate didn't want to move. So we didn't move.

Now every year the scientific community, NCAR out in Boulder, Colorado, the National Center for Atmospheric Research, would come and testify to us. And for a number of years they were saying, well, we really don't know enough. But a couple or three years ago they changed their tune and they said, yes, there are things that we don't know but we think we know quite sufficient, we have quite sufficient knowledge and quite a serious and credible enough data base to find some simple first steps that make sense, that are cost effective, that are sensible, that are not going to burden industry unduly and that are justified by our data base.

And of course they said, and we agreed, if you wait until you have a perfect data base, you will never do anything on any subject because the human condition is that there are things that we don't know and always will be things that we don't know. We wouldn't get out of bed in this morning if we had to have a perfect data base on what was going to happen to us during the day. We certainly wouldn't cross 42nd Street and Broadway. We certainly wouldn't take a trip on the New York City subway system which—I won't finish that sentence. [Laughter.]

So we share your view that we don't want any of us to be in this awful dilemma of having people shooting at us and saying we don't know enough. We have been through that, believe me, Dr. Leonard, and we couldn't sympathize any more with the point that you are making, and I would very much like to have you either formally or just in informal discussion with our staff help us come up with language that will solve that problem. We urgently would like to solve that problem.

Mr. **Leonard**. Mr. Chairman, we will make some of our scientific staff available to work with your staff to try to achieve that end.

Mr. **Scheuer**. Great. And if you have any other reservations—I do have a few more questions for you but I do want to get on to Dr.

Buffington—if you have any other reservations, let's face up to them. This thing is absolutely not frozen in concrete. We are getting into a whole new and infinitely complicated area. We are just trying to do the best we can. Human beings are—you know, human knowledge is not perfect yet. We are trying to cope as best we can in a sensible, cost-effective way with an infinitely complicated problem out there that really challenges our intellect in a way that is absolutely awesome.

So we welcome your help. We will be utterly delighted to sit down and chat with you about massaging this language, and we look forward to that. I will have a few more questions for you in a few minutes.

Okay. Dr. Buffington, deputy regional director for research of the Fish and Wildlife Service of the Department of the Interior.

As you know, your boss was a very valuable and constructive and hardworking member of this committee. We had a very pleasant relationship with him in terms of the product and the output of this subcommittee, and we look forward to working with you and him on this and other bills.

So please take five or six minutes, informally chatting with us, and then we will have some questions for all three of you.

STATEMENT OF DR. JOHN D. BUFFINGTON, DEPUTY REGIONAL DIRECTOR FOR RESEARCH, FISH AND WILDLIFE SERVICE, DEPARTMENT OF THE INTERIOR

Dr. Buffington. Thank you, Mr. Chairman.

With me today is Dr. William Gregg of the Park Service, who is the project coordinator on U.S. Man and the Biosphere, in case there are some issues that you might wish to explore.

Mr. Scheuer. Would you like him to join you at the witness table?

Dr. Buffington. He is right here, Mr. Chairman. If some questions come up, he can join us at that time.

Mr. Scheuer. All right. Very good.

Dr. Buffington. I appreciate the opportunity of appearing before you again to discuss the opinion of the Department of the Interior on H.R. 1268. As I look around the witness table, I appear to be the only surviving Federal agency witness from the three hearings that we have had before today.

There are several points that I would like to make. In the first place, in your comments to myself and other agency witnesses at the earlier hearings, you expressed a desire for greater communication and coordination among the Federal agencies on the questions associated with biodiversity. As several of us have mentioned in our written testimony, we have undertaken a formal dialogue for the Keystone Center to do just that. These hearings, I think, have been a very useful stimulant in initiating these discussions.

Secondly, at least I believe some of the desired results in H.R. 1268, in terms of the interagency working committee, I think will come about because of the discussions that are taking place through that process. So again I think that the work of your committee has already borne some fruit.

Thirdly, at least as far as my agency's participation in the Keystone Process is concerned, I think the points that we are willing to at least admit that the status quo is not absolutely the best of all possible worlds but at least consider the possibility that there is another possible world which might be better. But again that would lead me to echo the remarks of the two other witnesses here that we would prefer to see that dialogue continue to its logical conclusion before any legislation was enacted.

Finally, in response to questions that were raised earlier with Dr. Lovejoy, I would point out that even though our agency currently does not feel that this legislation is necessary, if the Congress should enact this legislation and pass the obligations on to the Department of the Interior, or especially to the Fish and Wildlife Service, that we would of course comply with the will of Congress.

And secondly, if any processes were established which would look to the Fish and Wildlife Service or other bureaus of the Department of the Interior to cooperate with the Smithsonian or any other agencies, we would of course be quite willing to comply with that as well.

That completes my statement, Mr. Chairman.

[The prepared statement of Dr. Buffington follows:]

STATEMENT OF DEPUTY REGIONAL DIRECTOR JOHN D. BUFFINGTON OF THE U.S. FISH AND WILDLIFE SERVICE, DEPARTMENT OF THE INTERIOR, BEFORE THE SUBCOMMITTEE ON NATURAL RESOURCES, AGRICULTURE RESEARCH AND ENVIRONMENT, COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY, U.S. HOUSE OF REPRESENTATIVES, CONCERNING H.R. 1268, THE NATIONAL BIOLOGICAL DIVERSITY CONSERVATION AND ENVIRONMENTAL RESEARCH ACT

May 17, 1989

Mr. Chairman, I am John D. Buffington, Deputy Regional Director for Research and Development of the U.S. Fish and Wildlife Service. I thank you for the opportunity to present the views of the Department of the Interior on H.R. 1268, the National Biological Diversity Conservation and Environmental Research Act.

The protection of biological diversity is a major concern of the Department, as evidenced by the various activities and programs in which we are involved. However, as I have indicated in earlier appearances before you, we believe existing authorities and programs are sufficient to accomplish the goals of the proposed legislation. Consequently, we oppose this bill.

Mr. Chairman, I would like to take this time to recognize the contribution this Committee has made in stimulating the national dialogue on biological diversity. In part, as a result of the attention you have brought to this issue, various Federal and State natural resource agencies and industry have become more involved in coordinating and planning efforts to enhance the conservation of biological diversity.

One of the major current activities--one, I might add, in which your staff is participating--is the dialogue taking place through the Keystone Center located in Keystone, Colorado. This Center was founded in 1975 as a non-profit science and public policy organization. One of its major activities includes working with interested parties in developing a consensus on issues of mutual interest. A number of Department of the Interior agencies, including the Fish and Wildlife Service, National Park Service, and Bureau of Land Management, have joined with the Environmental Protection Agency and the U.S. Forest Service and are committing time and money to attempt to come to terms on the biological diversity issue over the next eighteen months. In addition to Federal agencies and Congressional staff, participants include industry, conservation groups and academics. The Forest Service has been given the lead responsibility in this effort.

The first meeting in March of 1989 indicated that we can achieve a mutually agreed upon goal and an implementation strategy which will provide a common ground for effective future actions to ensure the perpetuation of biological diversity. Specific areas that are now under consideration include:

(1) managing ecosystems and species to sustain viable populations of native plants and animals throughout their geographic ranges;

(2) managing distinct biological communities, ecosystems, and their processes to maintain representative examples of all habitats and linkages of species and communities across regional landscapes;

(3) managing the genetic resources and demographics of desired species to sustain human well-being; and

(4) managing human activities and promoting awareness to sustain biological diversity and its uses, and to support policies and programs for its conservation.

One of the more interesting aspects of this process is that in many respects this dialogue among the agencies can achieve some of the same goals as the Interagency Working Committee proposed under section 7 of H.R. 1268.

In addition to the forum provided by the Keystone Center, the existing Committees on Earth Sciences and Life Sciences could also be used to coordinate biological diversity issues. Both of these Committees were established by the Office of Science and Technology Policy. I understand that their charge is to coordinate earth science and life science research activities among most of the same agencies included in Sections 6, 7, and 10 of H.R. 1268. Thus, as you can see, numerous frameworks for dialogue, coordination and strategy development on this issue already exist.

One of the frustrations that I believe has been common both to the Committee and to various agency witnesses is that we share a broadly stated goal, but the more narrowly defined objectives and an implementation strategy are where we seem to disagree. The strategy proposed in H.R. 1268 is but one of a number of possible approaches. The point of view provided in my previous testimony concerning the adequacy of existing agency authority is another. There are other views within the academic community.

Through the Keystone process, we have a forum within which to work toward adopting a common set of objectives and a common strategy. I respectfully suggest that the Committee, as well as the other participants, could profit from the outcome of that process.

That concludes my prepared statement Mr. Chairman, I would be glad to answer any questions you may have.

Mr. Scheuer. An important consideration that I would like to advert to briefly is this so-called Keystone dialogue, and several of you have referred to it in your testimony and oral comments.

For the benefit of the record and my colleagues, the Keystone recommendations are made by consensus, including industry representatives. Now in the normal course of events we very much want to achieve consensus—that is the purpose of this bill, of this hearing, to get all points of view and massage the bill and crank in some of the suggestions we hear—but I would make the point that the so-called Keystone dialogue has been going on for four or four and a half years on biotechnology, and it sometimes is difficult to achieve consensus.

It seems to me that as legislators we ought to get on with our job, do the best we can, be very forthcoming and open-minded with industry to meet their understandable and legitimate concerns. But it seems to me we can't hold a piece of legislation on which there is a generally perceived consensus, that is urgently needed, and I think Tom Lovejoy added on another couple of adjectives. We can't hold that legislation hostage to achieving a consensus between Government and private groups that has been a number of years in the making and on which there is still no perceived likelihood that that is going to be solved.

It seems to me that the council, when it was created, the interagency group, should be and would be prepared to embrace any consensus that makes sense coming out of the Keystone dialogue and that the way that we should be proceeding is to get on with this legislation, get whatever insights and recommendations this panel and others will have to contribute, and then pass the legislation and hope and can expect confidently that the views of the forestry industry will be fairly and open-mindedly received and will be reflected in the final actions and final policy determinations.

Now from your point of view, Dr. Buffington—and I would also ask Dr. Leonard this question—would it be helpful to have a structure such as the interagency committee in place under this legislation, to receive the Keystone report and immediately incorporate its consensus findings into a management strategy? Does that seem to you like a reasonable way to go?

Dr. Buffington. Well, I guess my own feeling is that, given that the agencies are participating—in fact I am personally participating—that there is the opportunity for the agencies to commit themselves to action via the process. And at this stage I just don't know if the additional step would be necessary.

It may turn out to be necessary, but I think it would be prejudging the effectiveness of the Keystone process. The Keystone process may fail, I don't know. But I think it is conceivable, reasonably conceivable, that by achieving consensus among ourselves, that consensus will be a call to action by the participants, including those Federal agencies that are participating.

Mr. Scheuer. Well, do I interpret your remarks then to mean that the fact that this, hopefully, consensus-creating dialogue is going on should not be a bar to the Congress, with all kinds of inputs from the executive branch, for the Congress to get on with passing this legislation in the hope and the expectation that when a consensus emerged it would be very cordially and cooperatively embraced under the legislation?

Dr. **Buffington**. There is of course the possibility the consensus would indicate a pattern of action other than what is included in your bill might be the way to go.

Mr. **Scheuer**. Then this process would contemplate that. It may discuss it. Nobody would rush to judgment. But there are going to be disagreements and those disagreements have to be honed and massaged and the sharp edges have to be taken off them so that we come up with a product of compromise that is reasonably acceptable to all the parties concerned.

You know, a proper compromise, by definition, should not be a total victory for any one party because then it is likely to be a total defeat for somebody else. No party should get everything that they want, but it should be satisfactory and it should be a result which everybody can live with, making the appropriate accommodations.

I don't want to press you on this, but does it seem to be a logical thing, a logical hope, that this bill ought to get passed? The machinery is there to encompass and accept consensus findings and that whenever the Keystone consensus process worked its way out it would be immediately considered and, hopefully, accepted in full or in most part by the process under the legislation.

Dr. **Buffington**. I think the position of my agency is that it would make more sense to await the outcome of the Keystone dialogue to see if it maybe should influence the final form of the legislation or even determine if any legislation were needed.

But I certainly see the relevancy of the context you are putting it in terms of pass the bill, wait for Keystone, and then pull them together at that time.

Mr. **Scheuer**. Well, what is your personal opinion? There are a lot of things in the bill that would be very helpful and very advantageous to have in place even at such time as the Keystone process might have produced consensus.

What is your personal opinion?

Dr. **Buffington**. My personal opinion on the interagency committee is I would prefer to await the outcome of the dialogue with the Keystone group.

Mr. **Scheuer**. All right.

Dr. Leonard, do you have any observations on these questions?

Mr. **Leonard**. There is certainly some advantage of having an entity to receive a report.

Mr. **Scheuer**. That's what we think.

Mr. **Leonard**. Our official position, and I think with some logic to it, is that we could wait till you get the report and then structure an organization within the confines of the recommendations of that report.

But I don't think it has to be an either-or. I don't think that one's approach is guaranteed to work better than the other. And certainly if there is an entity in place to receive the report and take action, there probably can be a reasonable expectation that you would move ahead quicker under that circumstance.

Mr. **Scheuer**. Well, all right. I think that I get the feeling you think it would be appropriate to go either way, it's a question of which should come first, the chicken or the egg.

Normally we don't hold legislation in hostage to a consensus-creating process, especially where it has gone on for a number of years, involving the private sector. We do our thing, and then when the private sector has a position and a statement and a point of view to express to us, then we, hopefully, deal with it in a very thoughtful and cooperative way.

Mr. **Leonard**. Mr. Chairman, if I might respond there.

Mr. **Scheuer**. Please.

Mr. **Leonard**. You know, I think it depends a little bit on whether or not it's possible, in defining some of the substantive requirements of the legislation, not the organizational requirements but the substantive requirements—for example, this issue again of the level of disclosure and the level within the biotic systems that we're talking about in terms of describing the impacts on or the substantive requirements for protecting the biotic diversity as we carry on programs—if the legislation is fairly specific as to what level it is going there, then I think that we can accommodate most any of the kinds of recommendations. And obviously if you come back to correct the legislation, that opportunity is there as well.

If the legislation in effect says we're going to approach environmental disclosure of the impacts on things in kind of an open-ended way that there is no definable point at which you've got that full disclosure, then I think it's going to make it very difficult for the interagency committee or anybody else to deal with the recommendations that would come out of the committee because if you have a very broad mandate, that is going to end up being interpreted by the courts rather than the Federal agencies.

Mr. **Scheuer**. Well, that would not be a happy result. That is not a good way to set policy or define programs, and we very much would hope that we could work with you in the weeks ahead to define sufficiently clearly what we expect from all parties concerned and the level of knowledge and data and specificity so that we could avoid the business of well-paid lawyers appealing to the court and, in effect delaying and obfuscating issues, as has been the practice in the past.

There ought to be enough leadership in industry and in Government and in the scientific community for us to come up with rational consensus answers to these problems.

Mr. **Leonard**. I agree.

Mr. **Scheuer**. And it would be a shame if there were frequent resort to the court. That would simply frustrate the process entirely and prevent almost anything from happening.

Dr. Jutro, did you want to add something?

Dr. **Jutro**. I just wanted to say that my comments on the Keystone process were simply to indicate that we had just joined it. We will be participating in the next round of Keystone activities, and in fact our laboratory in Corvallis, Oregon, has just hired a person who has in fact been active in the Keystone process. My testimony was merely meant to characterize the nature of our involvement, and not to reflect on the relationship between the Keystone process and any proposed legislation.

Mr. **Scheuer**. Yes.

We have just been joined by two very distinguished members of this committee, Congressman Tom McMillen and Congressman

Lamar Smith. So I am going to defer further questions. Frankly, I didn't even see them coming in. I erred.

So I will ask any further questions I have by letter, and I would like first then to recognize Congressman Lamar Smith.

Mr. **Smith**. Mr. Chairman, I appreciate both the introduction and the recognition, but I don't have any questions right now. Thank you.

Mr. **Scheuer**. All right. Well, we are delighted you are here, Lamar.

Congressman Tom McMillen?

Mr. **McMillen**. Thank you, Mr. Chairman.

I was sitting again. That's why you didn't see me when I came in. [Laughter.]

I appreciate the Chairman's recognition and the committee's holding these hearings today.

I was looking through Dr. Jutro's testimony and your comment about how this legislation, in your view, is premature. And I was trying to think through some different possibilities, and I was thinking about Dr. Hansen's comment, from NASA, about the greenhouse effect and possible global warming changes.

If in fact his view was accurate that we are seeing an accelerated climate change in this Earth of ours, would you consider our present systems to maintain biological diversity adequate?

Dr. **Jutro**. Could I ask you to clarify that question? Do you mean governmental systems?

Mr. **McMillen**. Yes. I would say our governmental systems. That's correct. I mean obviously what you are saying—I'm getting from your testimony that if you think this bill is premature then you think that presumably we are doing enough as is right now.

Dr. **Jutro**. Well, as I tried to explain earlier in response to a similar question, I was hoping that my comment would be construed to indicate that I was not able to present an EPA position at this time because Administrator Reilly, who as I suggested before would clearly be a major force in any environmental issues that face this administration, with the press of issues that have been facing him and the problems of staffing up, simply has not had an opportunity to review and evaluate this particular piece of legislation yet.

Mr. **McMillen**. Right. I see. So it is premature based on the fact that he has not been able to review it, is that it?

Dr. **Jutro**. Inasmuch as an EPA position would have to be articulated on an issue this substantial and important by the administrator, yes, sir.

Mr. **McMillen**. Yes. I was just scanning your testimony, and I didn't get that. I think it was that the legislative proposal is premature at the present time. I was trying to conclude if you felt at least that there was some reason why it shouldn't be implemented, and that had nothing to do with the Secretary's position. Is that an incorrect reading of this?

Dr. **Jutro**. As I said, sir, the Environmental Protection Agency does not have a position on the bill at this moment.

Mr. **McMillen**. Well, let me ask you, let me carry it a little bit further. If we are seeing an accelerated climate change, as Dr. Hansen believes, do you feel that our present systems of maintaining biological diversity in the Government are sufficient, in your own personal assessment?

Dr. JUTRO. In my personal opinion I think that there is a lot that really still needs to be done.

Mr. McMILLEN. So?

Dr. JUTRO. And I tried a few minutes ago to articulate a list of what I thought some of those scientific needs are.

Mr. McMILLEN. I guess the frustration here is that we are still trying to figure out where people really stand on these issues. You are the experts, we are here trying to evaluate the experts, and somehow it seems to me there is a real lack of inclination to talk about these things frankly and forthrightly in the Government.

I am not trying to——

Dr. JUTRO. Well, Congressman McMillen, what I said before is that in my personal opinion I felt that this is an issue that merits attention in terms of setting priorities for conservation and coordinating scientific activities, that we clearly do need to know more about a better understanding of natural systems and that there is a need to develop ameliorative techniques that don't yet exist and to figure out ways both scientifically and in terms of social science and economics to implement them.

I think it would be stretching the distinction between my EPA position and my personal opinion to discuss the institutional or legal aspects of the bill. But I was asked by you and by the Chairman for my personal opinion as a scientist in commenting on the bill, and I think that the ends that it foresees are important and necessary.

Mr. Scheuer asked me earlier whether I had any problems with the bill, and the only answer I would have to that is that the bill addresses quite strongly and places emphasis on issues of taxonomy and systematics.

Now, cataloguing is clearly a terribly important issue scientifically when one deals with the area of biodiversity, but biodiversity is part of biological conservation and it is an enormous task, but it is a part of a broader series of issues and my worry is that just having these lists won't be enough to solve the problem.

There is other work that needs to be done as well, in natural sciences, in status and trends and the relationships between organisms and systems and the processes that drive and support those relationships. There is a substantial amount of work that needs to be done in social science as well.

The one thing that I would urge the committee is that as a scientist again, in my personal view, that a serious look be taken at the investment strategy that is foreseen in the context of any given level of funding, because I think at different levels of funding that investment strategy and what your priorities will be could be substantially different.

Mr. McMILLEN. Just one quick follow-up. I guess what I am hearing is that you would favor in your own personal view a more integrated, coordinated approach to this whole issue. It seems to me that there is advocacy on your part of that kind of approach. So I might be inclined to think as well that this is a rather modest approach in that direction and maybe when your agency reviews this, that we may hear good things. Is that a possibility?

Dr. **Jutro**. I am afraid I am not in a position to comment on that, and I would question your use of the word advocacy. But as a scientist, in my personal opinion I have considerable sympathy for the scientific ends that are served by the thrust of this legislation.

Mr. **McMillen**. Thank you.

Mr. **Scheuer**. Thank you, Congressman.

Congressman Lamar Smith from the State of Texas?

Mr. **Smith**. Thank you, Mr. Chairman.

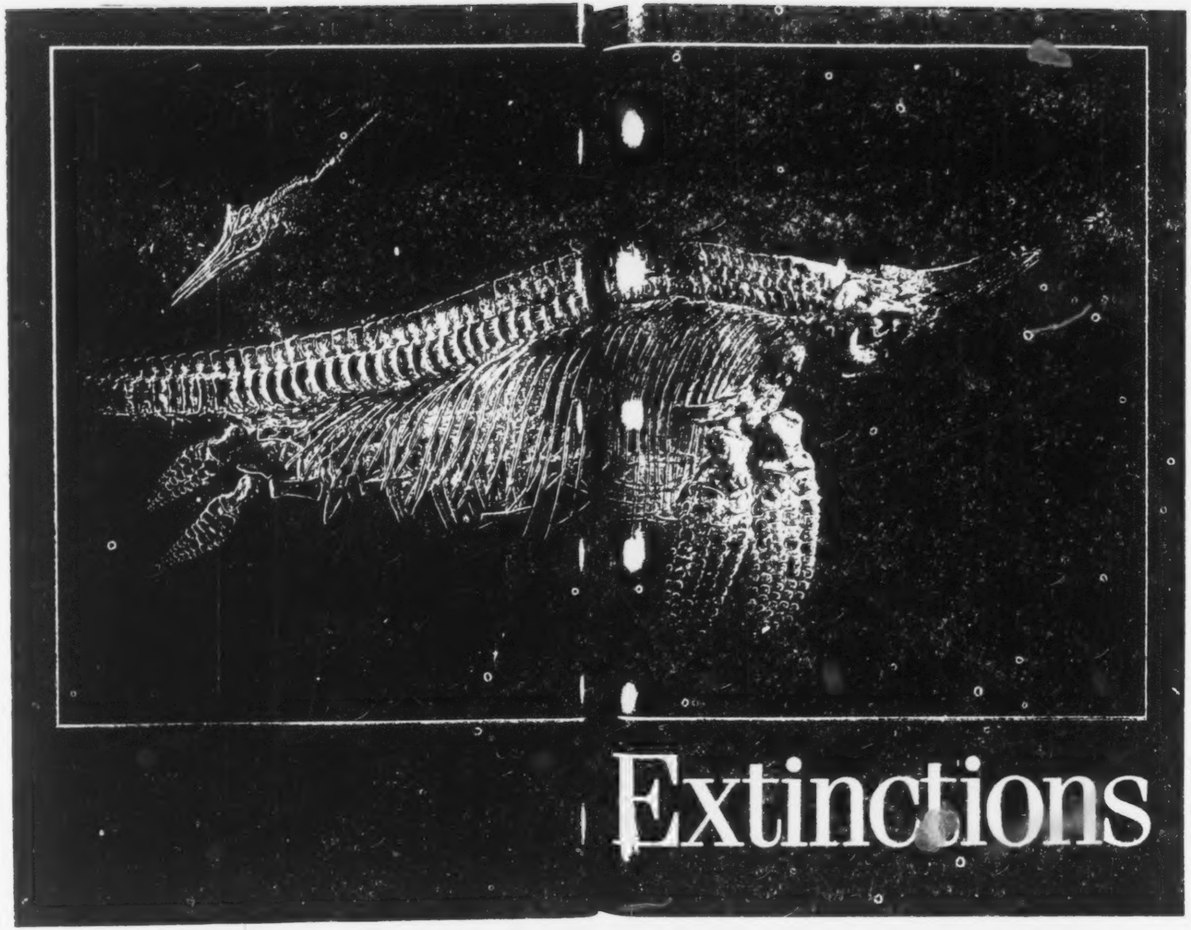
First, Mr. Chairman, I would like to ask unanimous consent to have inserted in the record today the most recent issue of National Geographic magazine, which we received at our house yesterday, which has, I believe, a cover or at least a lead article on the general subject of "Race Toward Extinction." And both the article itself and then one of those great maps that National Geographic has very graphically shows the progress towards extinction—"progress" is the wrong word, maybe it's the "slide" toward extinction—of a number of various animal species.

I think both members of this committee as well as some of our witnesses today might enjoy seeing that article.

Mr. **Scheuer**. There being no objection, so ordered.

I regret very much that in our publication of this hearing there is no way that they will be able to do justice to the pictures that adorn the National Geographic. But certainly the text will be of great interest to the members.

Mr. **Smith**. Thank you, Mr. Chairman.


Extinctions

THE JAWS of extinction threaten to snap shut on the California condor, foreground, a once widespread species reduced to about 30 birds by the presence of humans. Behind it looms the skull of Tyrannosaurus rex, a victim of the mass extinction that ended the Cretaceous period. A little T-rex lives on in the anatomy of modern birds, which evolved from dinosaurs some 150 million years ago.

HE WAS THE [illegible] of the free flyers. This ungainly bird his captors nicknamed Igor. His keepers now wince when they hear him called that. California condors are supposed to have real Indian names.

Chuuyu. Mowok. Pomo. For time beyond memory Indians throughout the West have regarded the condor as a god. His spirit, some say, inspired legends of the thunderbird, whose flight is responsible for the weather. Thunder is the flap of his wings, lightning the flash from his eyes. Today Igor's eyes, as he perches in his pen at the San Diego Wild Animal Park, are the eyes of extinction.

Igor, [illegible] Mr. [illegible] was the last wild [illegible] of his species. [illegible] he was trapped [illegible] hope to breed [illegible] until the world [illegible] once again [illegible]

Igor's [illegible] millions of dollars have been spent to [illegible] and preserve their habitat. That power has [illegible] remote from human [illegible] Other creatures have not [illegible] disappeared from the planet. [illegible] a hundred [illegible] among the most richly [illegible] have been destroyed. [illegible] can only [illegible] have vanished [illegible] lost in the [illegible]

Many [illegible] greatest mass extinction [illegible] the dinosaurs [illegible] the first birds. [illegible] are also those of [illegible]

[illegible] into the present. For [illegible] Ammonites. [illegible] extinction [illegible]

Mass extinctions. [illegible] the [illegible] Paleontologists [illegible] patterns. Yet [illegible]

[illegible] patterns in the fossil [illegible] history of life on the planet.

The [illegible] began in [illegible] when a team from the University of California at Lawrence Berkeley [illegible] boundary between the [illegible] period [illegible]

[illegible] NATURAL HISTORY MUSEUM OF LOS ANGELES COUNTY

[illegible] Scientists [illegible]

[illegible] the [illegible] Walter and [illegible] Alvarez, Frank Asaro, and Helen Michel [illegible] that earth had been hit by an asteroid ten kilometers [illegible] the proposal has [illegible] evidence [illegible] the great extinction [illegible] the dinosaurs died out.

[illegible] and handed it to me.

[illegible]

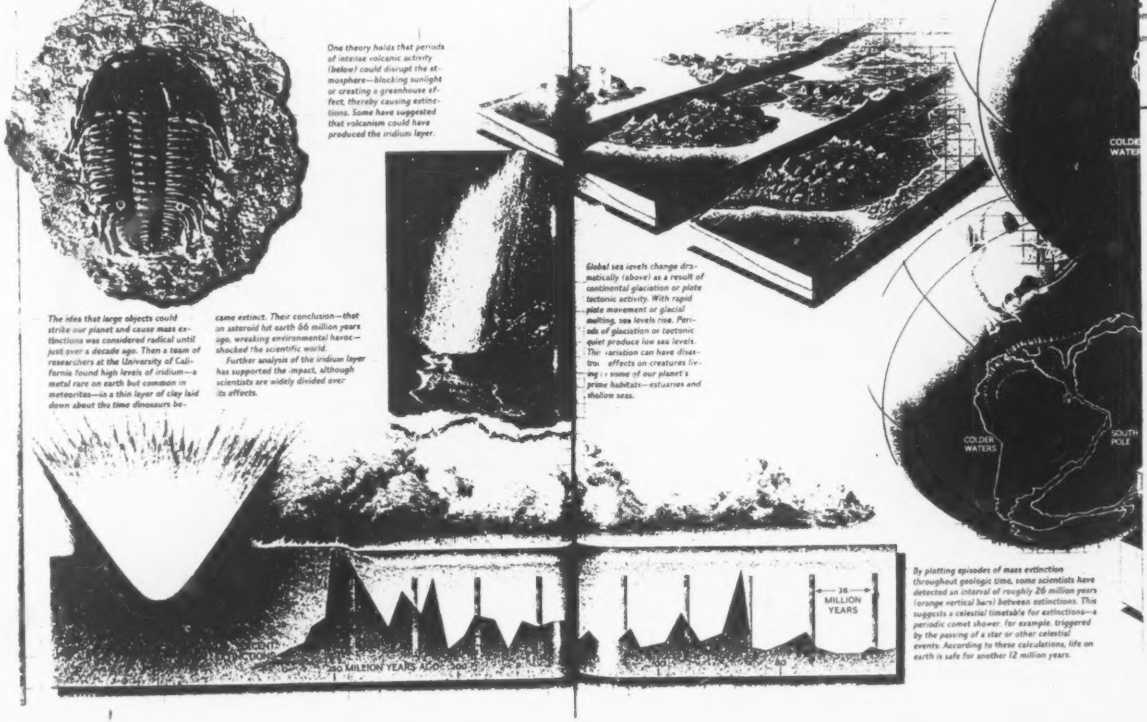
Mass extinction: the causes...

Through the study of fossil trilobites, below, and other creatures, scientists know that the story of life on earth has been punctuated by mass extinctions. But exactly how they occurred is a matter of unprecedented debate, sparked by the impact theory, lower left, and argued by scientists in fields as diverse as geophysics, astronomy and paleontology.

"These are exciting times to be looking at extinction," says NASA geologist Bevan French, stating one of the few conclusions on which all scientists agree.

At one end of the spectrum are those who believe mass extinctions are triggered by brief, cataclysmic events such as the impact of a celestial body or periods of intense volcanic activity. Others argue that the extinction process is gradual, brought on by environmental changes wrought by rapid tectonic, oceanic, and climatic fluctuations. Many scientists say the truth lies somewhere in between, as a combination of earthly and extraterrestrial causes.

cont-



One theory holds that periods of intense volcanic activity (below) could disrupt the atmosphere—blocking sunlight or creating a greenhouse effect, thereby causing extinctions. Some have suggested that volcanism could have produced the iridium layer.

The idea that large objects could strike our planet and cause mass extinctions was considered radical until just over a decade ago. Then a team of researchers at the University of California found high levels of iridium—a metal rare on earth but common in meteorites—in a thin layer of clay laid down about the time dinosaurs became extinct. Their conclusion—that an asteroid hit earth 66 million years ago, wreaking environmental havoc—shocked the scientific world.

Further analysis of the iridium layer has supported the impact, although scientists are widely divided over its effects.

Global sea levels change dramatically (above) as a result of continental glaciation or plate tectonic activity. With rapid plate movement or glacial melting, sea levels rise. Periods of glaciation or tectonic quiet produce low sea levels. This variation can have disastrous effects on creatures living in some of our planet's prime habitats—estuaries and shallow seas.

By plotting episodes of mass extinction throughout geologic time, some scientists have detected an interval of roughly 26 million years (orange vertical bars) between extinctions. This suggests a celestial timetable for extinctions—a periodic comet shower, for example, triggered by the passing of a star or other celestial events. According to these calculations, life on earth is safe for another 12 million years.

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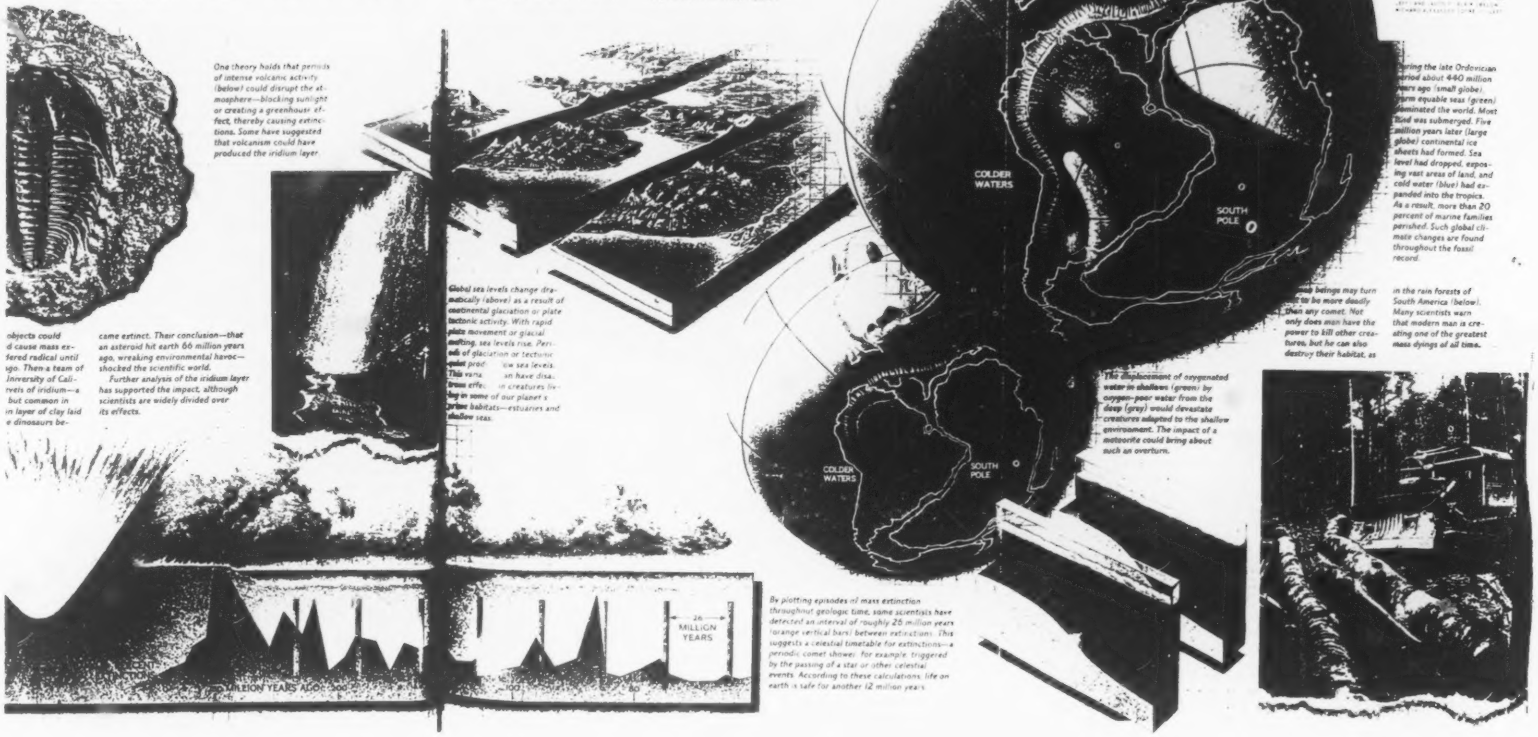

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The displacement of oxygenated water in shallows (green) by oxygen-poor water from the deep (grey) would devastate creatures adapted to the shallow environment. The impact of a meteorite could bring about such an overturn.

During the late Ordovician period about 440 million years ago (small globe) warm equable seas (green) dominated the world. Most land was submerged. Five million years later (large globe) continental ice sheets had formed. Sea level had dropped, exposing vast areas of land, and cold water (blue) had expanded into the tropics. As a result, more than 20 percent of marine families perished. Such global climate changes are found throughout the fossil record.

Human beings may turn out to be more deadly than any comet. Not only does man have the power to kill other creatures, but he can also destroy their habitat, as in the rain forests of South America (below). Many scientists warn that modern man is creating one of the greatest mass dyings of all time.

[illegible] DEPARTMENT OF EARTH AND PLANETARY [illegible] UNIVERSITY [illegible] PHOTOGRAPHERS [illegible] LEFT AND [illegible] RICHARD ALEXANDER COOKE [illegible]

The victims and survivors

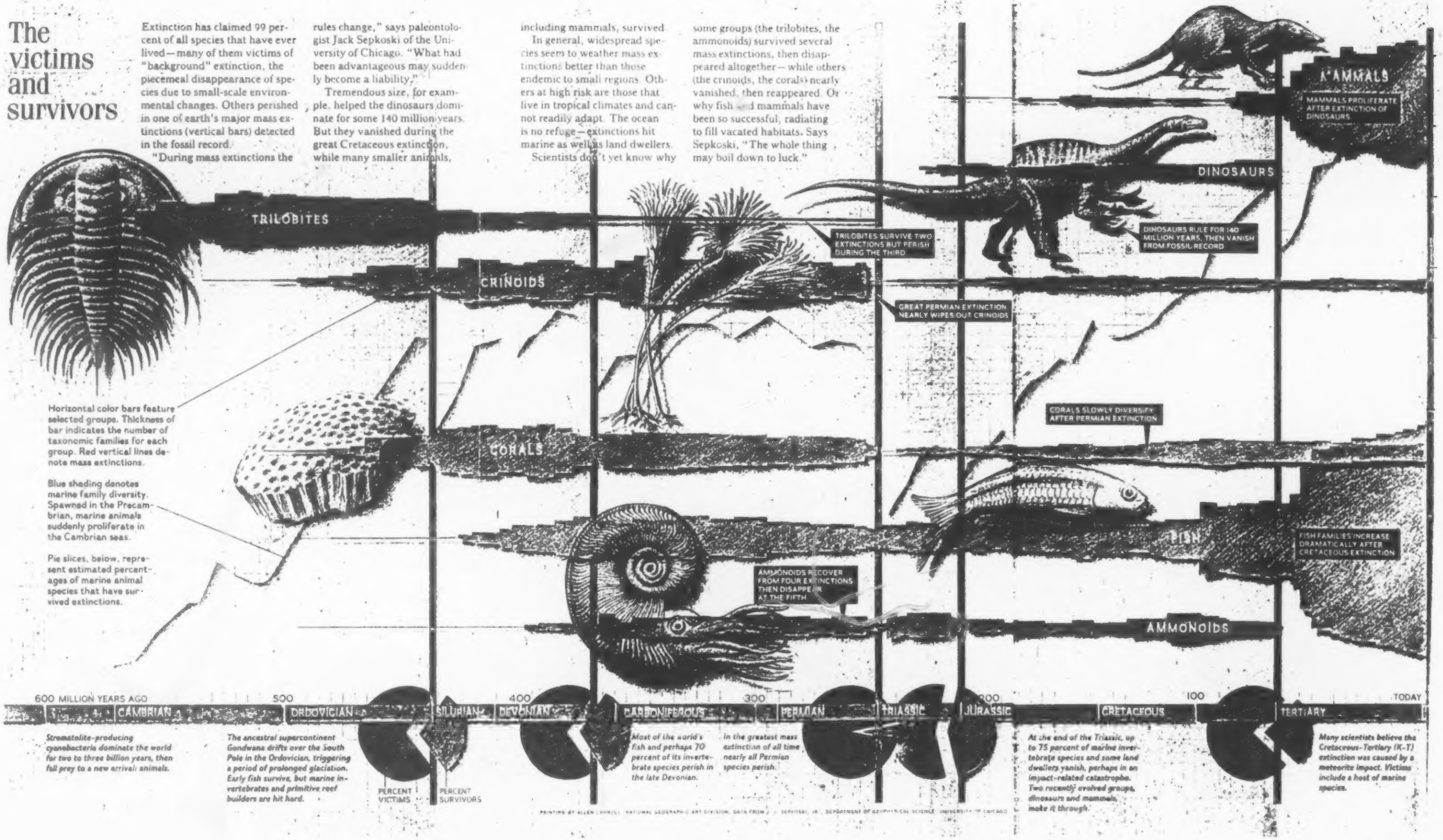
Extinction has claimed 99 percent of all species that have ever lived—many of them victims of "background" extinction, the piecemeal disappearance of species due to small-scale environmental changes. Others perished in one of earth's major mass extinctions (vertical bars) detected in the fossil record.

"During mass extinctions the rules change," says paleontologist Jack Sepkoski of the University of Chicago. "What had been advantageous may suddenly become a liability."

Tremendous size, for example, helped the dinosaurs dominate for some 140 million years. But they vanished during the great Cretaceous extinction, while many smaller animals, including mammals, survived.

In general, widespread species seem to weather mass extinctions better than those endemic to small regions. Others at high risk are those that live in tropical climates and cannot readily adapt. The ocean is no refuge—extinctions hit marine as well as land dwellers.

Scientists don't yet know why some groups (the trilobites, the ammonoids) survived several mass extinctions, then disappeared altogether—while others (the crinoids, the corals) nearly vanished, then reappeared. Or why fish and mammals have been so successful, radiating to fill vacated habitats. Says Sepkoski, "The whole thing may boil down to luck."



Horizontal color bars feature selected groups. Thickness of bar indicates the number of taxonomic families for each group. Red vertical lines denote mass extinctions.

Blue shading denotes marine family diversity. Spawned in the Precambrian, marine animals suddenly proliferate in the Cambrian seas.

Pie slices, below, represent estimated percentages of marine animal species that have survived extinctions.

Stromatolite-producing cyanobacteria dominate the world for two to three billion years, then fall prey to a new arrival: animals.

The ancestral supercontinent Gondwana drifts over the South Pole in the Ordovician, triggering a period of prolonged glaciation. Early fish survive, but marine invertebrates and primitive reef builders are hit hard.

Most of the world's fish and perhaps 70 percent of its invertebrate species perish in the late Devonian.

In the greatest mass extinction of all time nearly all Permian species perish.

At the end of the Triassic, up to 75 percent of marine invertebrate species and some land dwellers vanish, perhaps in an impact-related catastrophe. Two recently evolved groups, dinosaurs and mammals, make it through.

Many scientists believe the Cretaceous-Tertiary (K-T) extinction was caused by a meteorite impact. Victims include a host of marine species.

PAINTING BY ALLEN CARROLL, NATIONAL GEOGRAPHIC ART DIVISION; DATA FROM J. J. SEPKOSKI, JR., DEPARTMENT OF GEOPHYSICAL SCIENCE, UNIVERSITY OF CHICAGO change," says paleontolo ack Sepkoski of the Uni ty of Chicago. "What had advantageous may sudden ome a liability."

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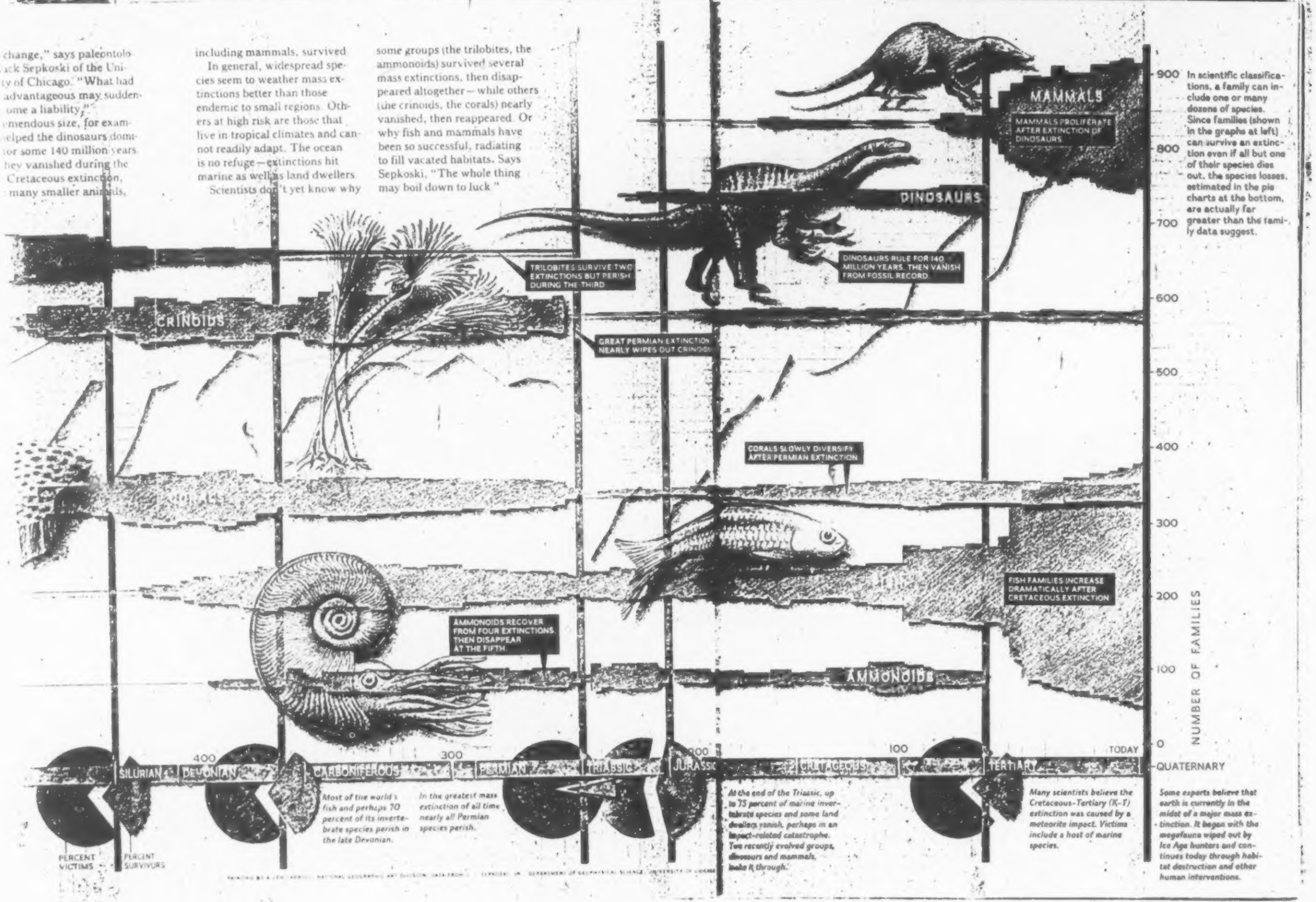

In scientific classifications, a family can include one or many dozens of species. Since families (shown in the graphs at left) can survive an extinction even if all but one of their species dies out, the species losses, estimated in the pie charts at the bottom, are actually far greater than the family data suggest.

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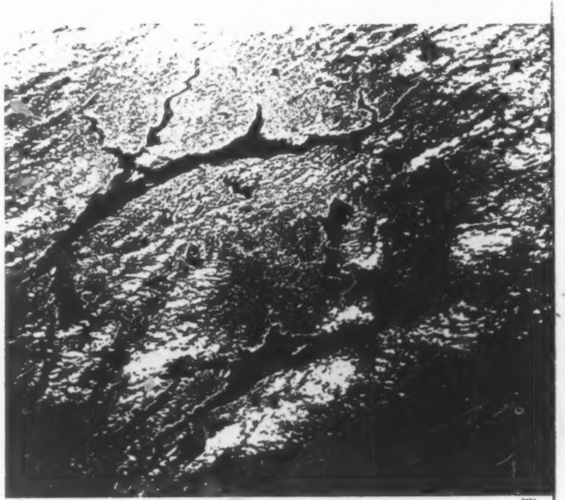
Some experts believe that earth is currently in the midst of a major mass extinction. It began with the megafauna wiped out by Ice Age hunters and continues today through habitat destruction and other human interventions.



NASA

CLUE to a killer's identity may remain in rugged central Quebec, where the Manicouagan crater was apparently blasted by a giant meteorite some 210 million years ago. That roughly coincides with a mass extinction of marine species at the end of the Triassic period. Sky-darkening dust from the impact may have played a role.

(Continued from page 665)

impact," he says. "In the first days after earth was hit, dust blanketed the entire world. It grew pitch-dark for one to three months. If the impact was on land, it probably got bitter cold. If it hit at sea, the water vapor could have created a greenhouse effect, making things hot. Hot nitric acid would have rained out of the atmosphere—a life-threatening rain that would have dissolved the shells of organisms."

That's not all. A surprising discovery by Wendy Wolbach, a graduate student at the University of Chicago, indicates that the world may have turned even nastier, as it did last summer at Yellowstone National Park.

A red sun shines like the eye of an angry god through the pall of billowing smoke at Old Faithful. A rush of heat. A swirl of suffocating, sooty air. Suddenly on the hillside behind the famous geyser the gates of hell burst open, and a fire storm races down the slope. A million acres on fire. The worst conflagration to strike the vast Yellowstone ecosystem in history. An awesome, terrifying orgy of flame. Yet this holocaust is insignificant compared with what Wolbach believes happened that day 66 million years ago when earth was hit. The entire world caught fire.

Even as Yellowstone burns, Wolbach shows me her evidence in her Chicago office—scanning electron microscope pictures of soot particles embedded with the iridium layer from three widely separated sites—Denmark, Spain, and New Zealand.

Wolbach's discovery stemmed from the curiosity of her research adviser, cosmochemist Edward Anders, about what kind of extraterrestrial object had struck the planet at the K-T boundary. A meteorite from the asteroid belt? A comet? He suggested that Wolbach attempt to isolate carbon in the iridium layer. Carbon would have trapped certain rare gases brought in by the impacting object. The isotopes of those gases might provide chemical signatures to identify the intruder from space.

To her surprise Wolbach has found an enormous enrichment of soot.

"To get the amount of soot we find," she says, "as much as 90 percent of the world's forests must have burned."

Granted the impact of a ten-kilometer body would be equivalent to 10,000 times the power of all the world's nuclear weapons, how could fire spread so disastrously across the globe?

"Even if it hit in the ocean, the impact would have created a crater 300 kilometers across," says Anders. "A huge plume would have pushed the atmosphere aside. The fireball would have had a radius of several thousand kilometers. Winds of hundreds of kilometers an hour would have swept the planet for hours, drying trees like a giant hair dryer. Two-thousand-degree rock vapor would have spread rapidly. It would have condensed to white-hot grains that could have started additional fires."

In addition, lightning discharges like those in a volcanic eruption could have ignited windswept fires on all landmasses that marched far faster than those at Yellowstone.

SUCH DOOMSDAY SCENARIOS strain our belief. And many scientists refuse to accept that such catastrophes have caused the great dyings.

"We don't need an impact," I have heard over and over from paleontologists. "We can explain mass extinctions with earthly causes."

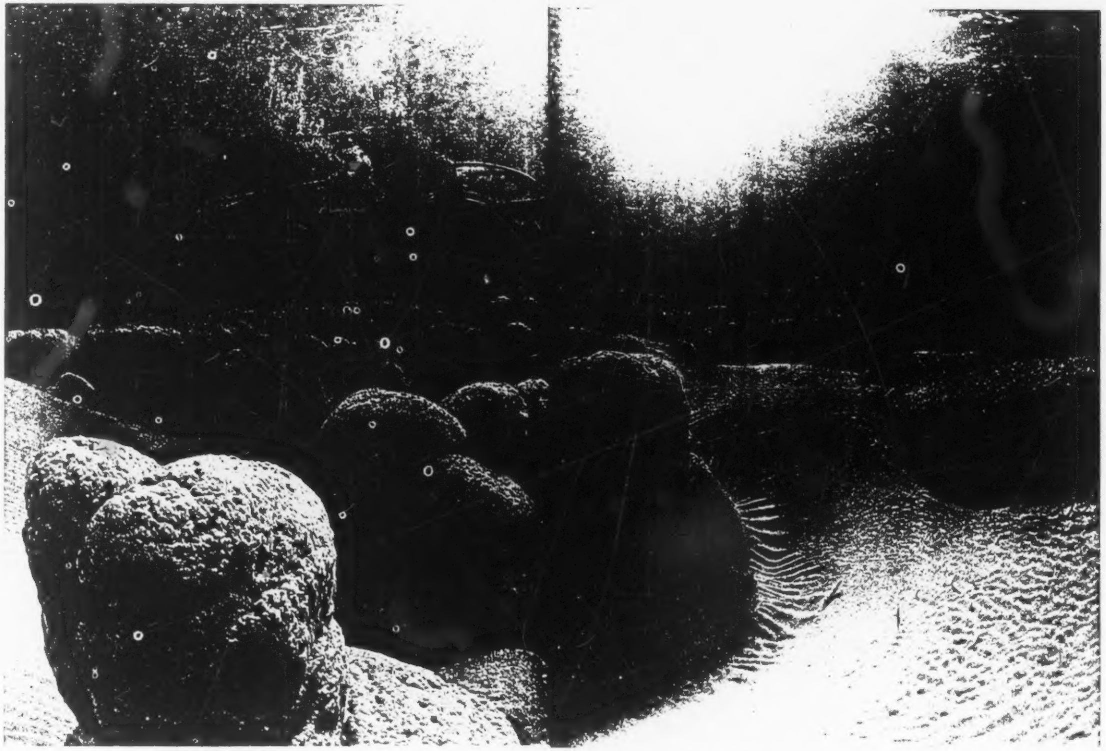
And so they can. Falling sea levels. Ice ages. Collisions of continents. Volcanism. Climate changes. Altered ocean chemistry. The potential mechanisms for mass death are many.

No matter what causes them, mass extinctions do occur. They force a new perspective on the history of life.

"Mass extinctions change the rules of evolution," explains David Jablonski of the University of Chicago, one of the leading extinction theorists. "When one strikes, it's not necessarily the most fit that survive; often it's the most fortunate.

"When their environment is disrupted, groups that had been healthy can suddenly find themselves at a disadvantage. Other species that had been barely hanging on squeak through and inherit the earth.

"The best example is mammals. Dinosaurs and mammals originated within ten million [illegible] each other about 220 million years ago. But for 140 million [illegible]saurs ruled, while mammals stayed small and scrambled around [illegible] out in the underbrush. Mammals all basically looked alike—squ[illegible] or shrewish and no bigger than a badger—until the dinosaurs disappeared. Then they took off. Within ten million years there were mammals of all shapes and life-styles: whales and bats, carnivores and grazers. Mammals just couldn't do anything interesting until the dinosaurs were out of the way."



Living examples of stromatolites were recently discovered by geologists of the Caribbean Marine Research Center in shallow waters off the eastern Bahamas. The mounds are composed of sticky mats of cyanobacteria, formerly known as blue-green algae, that cement sand and sediments. Appearing in rocks 3.5 billion years old, stromatolites are the earliest known communities of life. They declined dramatically between 500 and 700 million years ago and survive today only in environments hostile to predators, such as this area swept by swift channel currents and in hypersaline waters in Western Australia, where a community was found three decades ago.

Mass extinctions thus promote new beginnings, new eras of experimentation. If earth's slate of life were not episodically wiped clean, how far might we have evolved beyond the primordial slime?

That slime surely suffered too. The first great extinction may have been a gas attack. As one microbiologist explains: "It was the worst case of pollution in earth's history."

What was this toxic waste, this obnoxious gas? Paradoxically, it was what today sustains all animal life: oxygen.

DESCENDANTS *of the stromatolite builders, mats of modern cyanobacteria survive in environments too harsh for most life—such as in this 42°C (108°F) hot spring rivulet in Yellowstone National Park. No threat to the cyanobacteria, the wolf spider is a relative latecomer; his ancestors appeared about 400 million years ago.*

At one time earth's oceans and atmosphere were virtually oxygen-free, or anaerobic. Carbon dioxide dominated the planet. Then, about three billion years ago, certain bacterial members of the primordial slime invented the kind of photosynthesis that releases oxygen as a waste product.

Oxygen is a reactive, aggressive gas. It shuts down or burns out organisms adapted to anaerobic life. So with oxygen the new aerobic bacteria could coerce their way into a place in the sunlight and drive their competitors underground or into extinction.

The waste built up. The oceans were oxygenated, then the skies.

No organism has so dominated the world as did those filamentous oxygen-producing microbes. Wherever seas were warm and not too deep, they built diverse bacterial communities—mound-shaped mats of microorganisms. The fossils of those mats, called stromatolites, resemble great reefs of cabbage-shaped mounds. Beds of layered stromatolites, often several kilometers thick, swirl through rocks that were formed in shallow seas between 2.5 billion and 600 million years ago.

Then stromatolite populations crashed. Like the anaerobic life they displaced, stromatolites still exist but can be found only in isolated areas. What happened?

In a word, animals. Life began to feed on itself.

THE APPEARANCE of animals heralded the adoption of a new survival strategy. Photosynthesis had enabled organisms to make their own food from carbon dioxide and water. The new strategy bypassed that step. Why make your own food? Why not eat some organism that has already done the work? Eating someone else takes energy, however. You have to graze or hunt. That requires a high-powered aerobic, or oxygen-burning, metabolism. As the advent of oxygen made grazing animals possible, it made sitting ducks of the stromatolite builders.

Animal life exploded across the planet at the start of the Cambrian period, around 570 million years ago. Perhaps oxygen levels crossed a threshold that enabled animals to make shells and experiment with increasingly complex tissue.

"For 25 million years life was unconstrained," says University of Chicago paleontologist Jack Sepkoski. "If evolution had continued at the rate we see at the Cambrian-Precambrian boundary, we'd have shrimp Newburg from New York to London."

By the time Cambrian seas filled, about 545 million years ago, life had evolved nearly all the phyla, or basic body plans, that it uses today. But one body plan dominates the fossils of that great epoch: that of trilobites.

ILLUMINATING *earth's dark ages, David Ward of Montana State University bathes cyanobacteria in ultraviolet light, causing chlorophyll to fluoresce. Its presence indicates photosynthesis, a process that literally changed the world 2.5 billion years ago. Such photosynthetic microbes released oxygen into the biosphere, allowing oxygen-based life to develop.*

PHANTOMS OF TRILOBITE DAYS haunt central Utah's House Range as geologist Pete Palmer drives me to the site of the first mass extinction of animals clearly documented by the fossil record. At least three times toward the end of the Cambrian, trilobites, distant cousins of horseshoe crabs, were nearly extinguished by mysterious, perhaps global, disasters. Their bodies litter this former seafloor with what Palmer calls "trilobite trash"—a head here, a tail there.

"Trilobites were innocuous creatures," says Palmer, who works for the Geological Society of America. "Most were somewhere between one and six inches long. They couldn't bite. They weren't vicious. Some were floaters, some swam. Mostly they were mud grubbers. Their mouths faced backward. They had multiple legs that brought food to their mouth. They may have scavenged soft fleshy stuff or eaten marine algae."

Trilobites lived in a flooded world. Sea levels were high. Minneapolis would have been coastal. The rocks of Utah's House Range were part of a limestone platform offshore, like today's Bahamas.

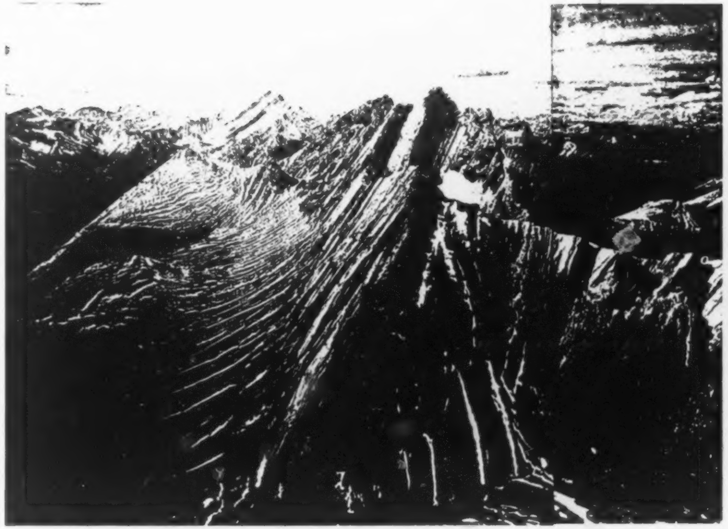
We drive dirt tracks into Little Horse Canyon, then climb up through what had been Cambrian muds to a gray limestone shelf. A line about as thick as my fingernail runs across the rock. Below the line all the trilobite trash is made up of "roundheads," Palmer's name for the roundheaded family that dominated the mud.

"This line coincides with a crisis," says Palmer. "We suddenly lose the roundheads. In the rocks just above us there's nothing but very primitive trilobites with square heads. They came in like the Mongol hordes. They had to be hiding out in some special local environment, maybe in the deeper, colder waters farther offshore. Once the world was theirs, they diversified rapidly.

"Then one day, bang . . . ."

Palmer points to a ledge high above our heads. "Up there the same thing happens to the squareheads. Then another group of trilobites appears by the millions. At the end of the Cambrian period, their descendants too are decimated and never come back strongly."

What happened?



FORMED in the shallow sea that covered western North America 370 million years ago, limestone exposed in the Ancient Wall—a range in Canada's Jasper National Park—may hold fossilized answers to what caused a mass dying of reef-building invertebrates during the late Devonian period.

EYE TO EYE with the Devonian disaster, Helmut Geldsetzer of the Canadian Geological Survey examines fossils exposed on an outcrop near the Lyell Icefield in British Columbia. He believes a sudden flooding of shallow seas by oxygen-poor water from the deep may have killed the reef builders. The cause, he suggests, "might be an asteroid impact."

"Maybe an extraterrestrial object splashed into the ocean," says Palmer. "Perhaps, like today, the seas were strongly stratified—warm, oxygen-rich upper strata on top of cold, oxygen-poor deep water. If you threw that deep water onto these shallow shelves, you could have devastated the trilobites living there. Those organisms couldn't stand even a few weeks of that."

That scenario could explain the squarehead survival. Being primitive, they had been pushed to the cold, deep margins where no other creatures could make a living. They had adapted to just those conditions that exterminated their more advanced competitors.

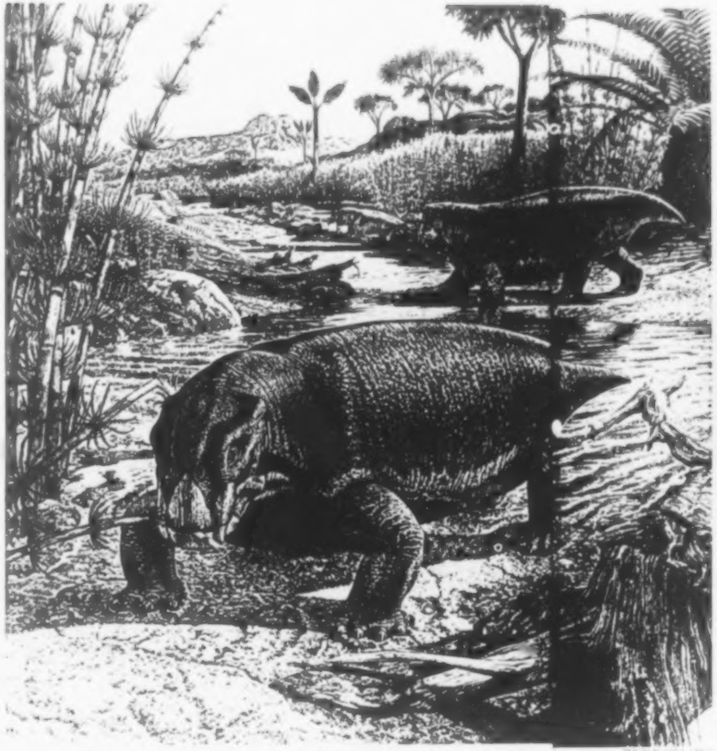
AFTER THE CAMBRIAN, trilobites never bounced back. Sophisticated new predators, suggests University of Washington biologist Peter Ward, made their life style obsolete. Nautiloids, distant relatives of today's chambered nautilus, combined massive size with the ability to move swiftly across the seafloor. "As the airplane revolutionized modern warfare, the nautiloids created havoc for cambrian [illegible] creatures," says Ward. "The early trilobites only looked ahead. The ones that survived also looked up."

Reef life—aborted early in the Cambrian—evolved anew in the Ordovician. Clams, starfish, and crinoids, lily-shaped animals that made gardens out of sea bottoms, also emerged. Then around 440 million years ago this increasingly diverse global ecosystem collapsed.

The most obvious villain in the massive Ordovician extinction was the planet's own restlessness, the inner turmoil forever moving earth's continents about. In the late Ordovician that turmoil drove a huge, ancient continent, Gondwana, over the South Pole. Immense glaciers developed, drawing their water from the oceans and chilling even the tropics. "The ice age virtually drained the shallow seas," says paleontologist Peter Sheehan of the Milwaukee Public Museum.

Reef life was especially hard hit during the Ordovician extinction.

"Reefs are attractive but dangerous places to live," says David Jablonski. "The hybrid [illegible] so complicated that the entire community [illegible] a few of its members go. Reefs are always [illegible]"

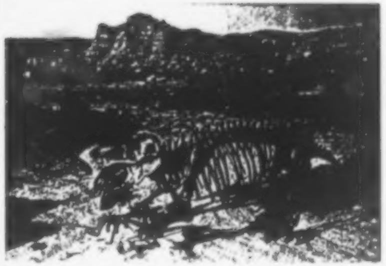


SQUAT LYSTROSAURUS, *a mammal-like reptile, represents a lineage that survived the greatest mass dying of all time, at the end of the Permian. Like his cow-size relative Placerias (right), the cast of whose skeleton was photographed in Petrified Forest National Park, Lystrosaurus was herbivorous.*

With the drifting of Gondwana beyond the polar region and the decline of the ice age, the reefs rebounded with altered life forms. For the next 75 million years they flourished, laying limestone bedrock across much of earth's crust, including the Great Lakes region. Today those fossil reefs give the ground beneath Chicago the strength it needs to support some of the world's tallest skyscrapers.

As the reefs were recovering, the seas saw an explosion of huge predatory fish. Land plants evolved, as did the first amphibians. The biological stage was being cast with players for the next tragedy.

The late Frasnian, scientists call the great extermination toward the end of the Devonian period 370 million years ago. It exposes itself most strikingly in the Canadian Rockies, where massive Devonian reefs have been sheared and tilted by earth movements. Jutting skyward like great shards in remote alpine splendor, the mountains are pocked with mementos of their birth—shells and the skeletons of corals and similar creatures.

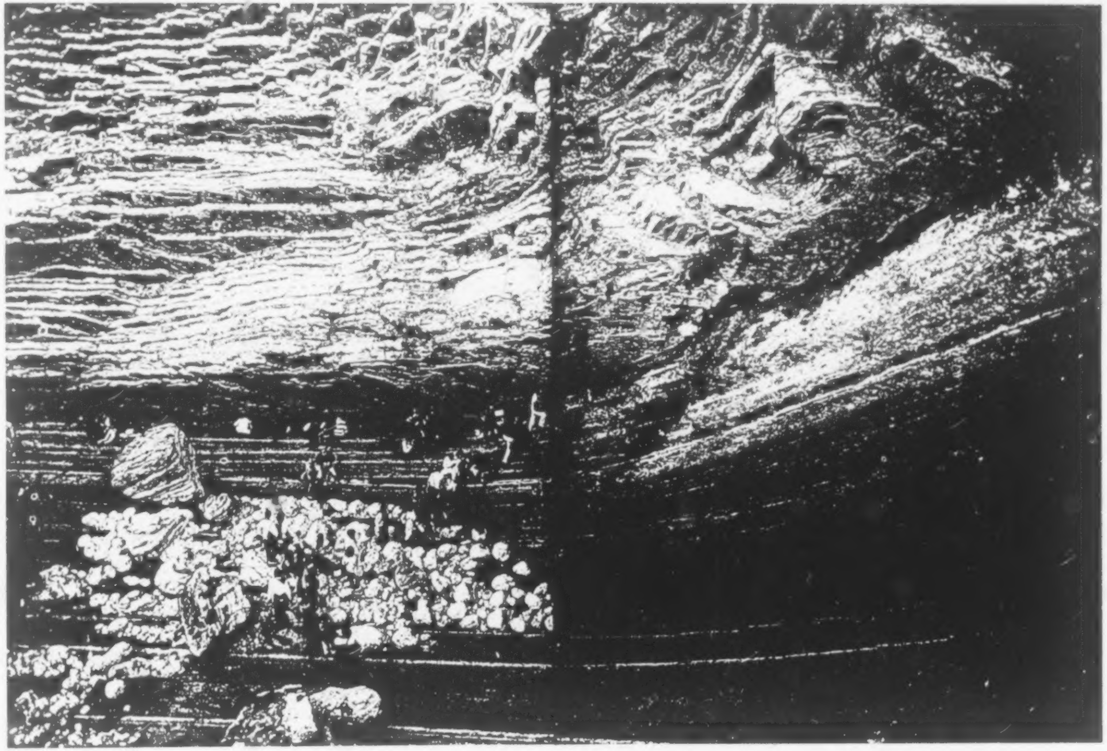


With Helmut Geldsetzer of Canada's Geological Survey I climb into the Rockies. We reach a thin yellow band, a sulfur mineral, which Geldsetzer believes precipitated as oxygen suddenly vanished from the upper layers of the oceans. As that band was deposited, most of the world's fish and 70 percent of its invertebrates perished.

"The seas would have looked like the aftermath of a global red tide—dead animals floating everywhere," says Geldsetzer.

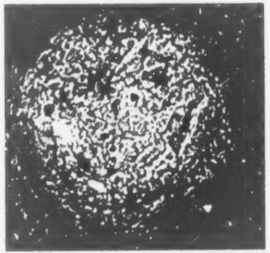
He hammers out a piece of the yellow rock. Once again I can put my fingers on a mass extinction. I ask what did the killing, what sapped the seas of oxygen. He invokes the same killer that Palmer suggests ravaged the trilobites: the splash of an extraterrestrial impact flooding the continental shelves with anoxic water from depth. He notes that iridium has been found in Devonian rocks in Australia.

Other scientists reject this idea. They argue that the Australian iridium was concentrated by mats of organisms and that the extinction resulted from a cooling of the oceans as Gondwana headed back over the South Pole and new glaciation approached. These experts maintain that the extinctions were spread out over several million years. But the



[illegible] a thin layer of spherules scrutinized by scientists [illegible] Zumaya, Spain [illegible]

[illegible] evidence of an impact — including high levels of iridium. Debate rages over the [illegible] depth of the oceans. But [illegible]



STANLEY A. MARGOLIS AND ERIC F. [illegible]

EVIDENCE of impact, this tiny spherule collected from the K-T boundary layer at Zumaya is thought to be a melted fragment of the object that struck the earth 66 million years ago. The spherule, here magnified 5,000 times, contains platinum in the high concentration present in meteorites but not normally found on earth.

catastrophists heatedly disagree, arguing that the event was abrupt, worldwide, and occurred in the midst of a long warm spell.

"At most we are dealing with 20,000 years—and maybe just one stormy night," says Willi Ziegler, director of the Senckenberg Museum in Frankfurt.

With Charles Sandberg of the U. S. Geological Survey, Ziegler has studied fossils of abundant small eel-like animals known as conodonts. The shapes of conodonts changed often and distinctively enough during the Devonian that scientists can date rocks precisely with them. Particular conodonts in a rock indicate whether the rock formed in deep or shallow seas.

Ziegler and Sandberg's conodont analysis indicates great swings of sea level around the time of the extinction. They see shallow-water conodonts suddenly appearing in deep-sea rocks. They argue that storms, and perhaps tsunamis, ravaged the planet, washing near-shore life out to sea. In Nevada, which was then deepwater terrain, Sandberg has found huge boulders of coastal rocks that were apparently ripped seaward.

"We suspect this was caused by a comet shower or increasingly closer passes by an asteroid or field of asteroids," says Sandberg. "An asteroid's gravity could raise great tides. Imagine the stress on marine life if sea levels went up 30 meters, then dropped 60."

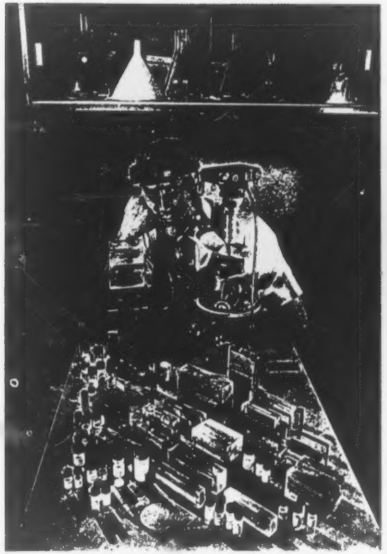
Wild thoughts? There are data from the Devonian to support endless speculation. The confusion grows worse with the next extinction, which terminated the Permian period about 240 million years ago.

THE PERMIAN was easily the greatest extinction of all time. Perhaps 96 percent of all species disappeared. No one yet claims strong evidence for an extraterrestrial extinguisher. The best guess today is that the planet itself did the killing.

The Permian extinction was the first to affect terrestrial life significantly. During previous extinctions most life was confined to the water. But by the end of the Permian, coal swamps had proliferated, insects swarmed, and pig-size amphibians were roaming across earth's warm surfaces. Creatures known as mammal-like reptiles dominated the land.

Mammal-like reptiles varied enormously. Early versions resembled lizards, but reconstructions of later species make me think of a dog-faced tank with a short tail. They may have had fur, and to specialists their bone and teeth structure looks more mammalian than their simultaneously evolving reptilian cousins. For example, their limbs extended directly beneath their bodies, rather than to the side, as is the case with reptiles.

Even as the mammal-like reptiles were evolving during the Permian, the forces of plate tectonics were forging the supercontinent Pangaea, joining all the planet's continents into a single colossal landmass. With but one continent the amount of shallow offshore water—among the richest habitats on the planet—shrank drastically. Also, Pangaea encroached on both poles, probably triggering a series of crippling ice ages in both hemispheres. According to paleontologist Bob Sloan of the University of Minnesota, sea levels bobbled up and down by 200 meters; coastlines advanced and retreated 1,900 kilometers (1,200 miles). Even tropical seas would have been chilled. On land climate grew progressively drier, the winters Siberian.



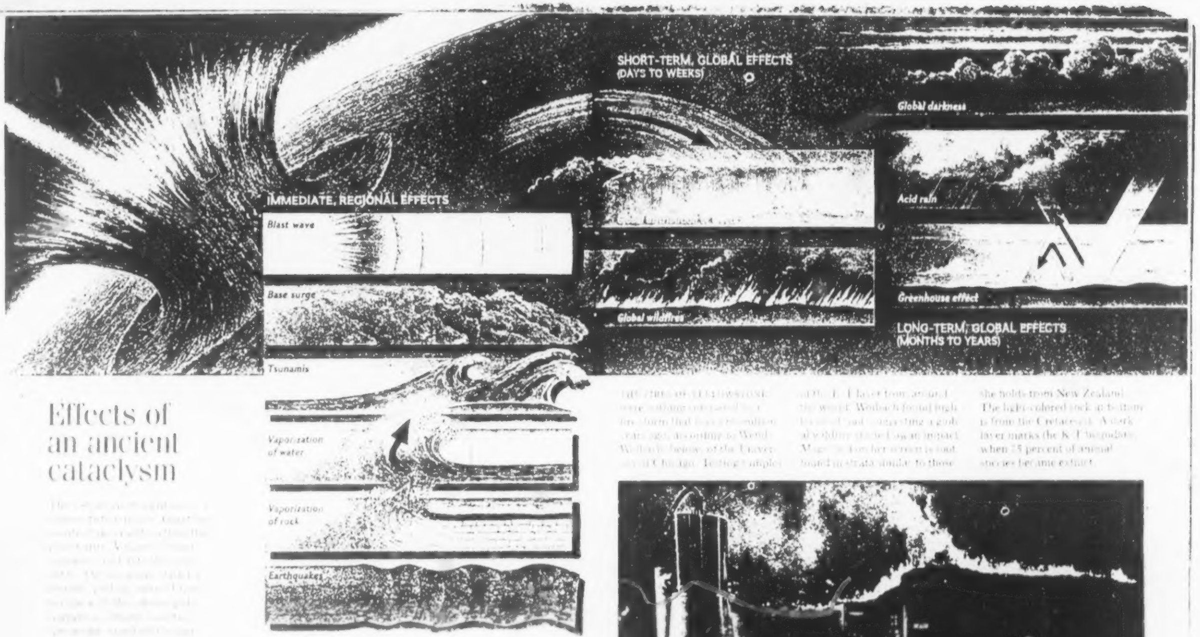
***GEO-DETECTIVE** Glen Izett of USGS was skeptical about the impact theory. Then his light-polarizing microscope revealed quartz grains in samples of the K-T layer (above) with the type of fractures caused by nuclear explosions or meteorite impacts. Judging from the size and abundance of "shocked" quartz grains he has found in the western U. S., Izett believes the impact occurred there.*

The mammal-like reptiles suffered at least six distinct mass extinctions during the last eight million years of the Permian, says Sloan, indicating that the great die-offs may occur in pulses. These pulses reflect the Permian's strong climatic swings. The die-offs illustrate that, paradoxically, extinctions can benefit life.

"Look at what survived each pulse," says Sloan. "The survivors were always those that appear to be more warm-blooded and thus dealt better with cold climate. They also tended to have more complicated jaws and teeth, as well as more efficient respiratory systems."

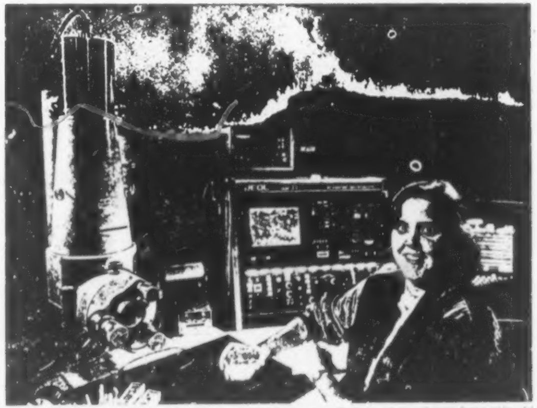
Moreover, the extinctions were steadily establishing a pattern for subsequent terrestrial extinctions. As Sloan says, "The [illegible]

Effects of an ancient cataclysm


IMMEDIATE, REGIONAL EFFECTS
Blast wave
Base surge
Tsunamis
Vaporization of water
Vaporization of rock
Earthquakes
SHORT-TERM, GLOBAL EFFECTS (DAYS TO WEEKS)
Global wildfires
Global darkness
Acid rain
Greenhouse effect
LONG-TERM, GLOBAL EFFECTS (MONTHS TO YEARS)

[illegible]

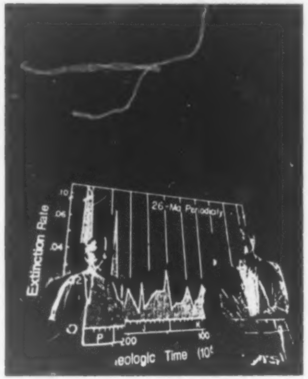
THE FIRES OF YELLOWSTONE were nothing compared to a fire storm that [illegible] 65 million years ago, according to Wendy Wolbach, [illegible] of the University of Chicago. Testing samples of the K-T layer from around the world, Wolbach found high [illegible] soot, suggesting a global wildfire started by an impact. Magnified on her screen is soot found in strata similar to those she holds from New Zealand. The light-colored rock at bottom is from the Cretaceous. A dark layer marks the K-T boundary, when 75 percent of animal species became extinct.



extinction is to be large." Big creatures need more food and have more trouble finding hideouts.

One squat creature whose ancestors made it through the end of the Permian was a tusked herbivore called *Lystrosaurus*. About as cute as E. T., *Lystrosaurus* exploded across Pangaea after the Permian—largely because there wasn't much left big enough to eat it.

In the ensuing Triassic period evolution soon produced not only large new mammal-like reptiles but also waves of new experiments. Marine monsters called ichthyosaurs began to prowl the seas, crocodiles the swamps. Flying pterosaurs took off.



The first dinosaurs also appeared. Extremely fast and small, they often were two-legged, probably resembling big pheasants on the run. Their upright posture freed their forelegs to be used like hands for grasping.

If not warm-blooded, most dinosaurs had evolved high metabolic rates. Some perhaps were covered with down, and later, feathers. Nevertheless, for a while dinosaurs waited in evolution's wings. Although they were superior players, the dinosaurs could not, by themselves, displace the mammal-like reptiles.

AT THE CLOSE of the Triassic period, about 200 million years ago, the dinosaurs may have gotten a little help from the cosmos. In the wilds of central Quebec sits the Manicouagan crater, half the size of Connecticut. The only radiometric dating of remote Manicouagan puts that impact several million years before the end of the Triassic. However, paleontologist Paul Olsen of Columbia University's Lamont-Doherty Geological Observatory suspects that the dates are wrong and that the Manicouagan impact is the fingerprint of a global mass extinguisher from space.

"The fireball alone from an impact that size would have scorched everything down to New Jersey," he says. It thus could have created the kind of global havoc suspected at the K-T boundary.

Whether or not they had cosmic good fortune, the dinosaurs took charge of the land with the advent of the next period, the Jurassic. During the Jurassic's 60 million years, the great reptiles developed sovereign size. The gargantuan *Brontosaurus* and related creatures roamed river plains, browsing tall conifer trees. So did the armored, tractor-size *Stegosaurus*, although it might have had to stand on its two hind legs to nibble the branches. It had to stay ever alert for the huge meat-eating *Allosaurus*.

These monsters vanished, along with many smaller dinosaurs and marine creatures, when a profound but mysterious crisis struck at the end of the Jurassic. A new generation of low-browsing, beaked dinosaurs emerged. What made them the evolutionary victors? Was there a global habitat change? Why was life in the oceans also hard hit? The Jurassic mass killer left almost no clues.

Dinosaurian life rebounded vigorously during the long warm eons of the ensuing Cretaceous period. Then, about 90 million years ago, another poorly understood pulse of extinctions struck both land and sea. One modest spike of iridium has recently been reported for this mid-Cretaceous extinction, implying impacts from space. Because other spikes have not been uncovered for this boundary, the significance of the lone spike is being challenged. But there may be a more surprising suspect for agents of extinction—flowers.

About this time blooming and fruit-bearing plants, known as angiosperms, began to explode across the land. By attracting animals to spread their pollen and seeds, the angiosperms colonize quickly. They also reproduce rapidly. Controversial dinosaur expert Robert Bakker of the University of Colorado argues that the new generation of low-browsing Cretaceous dinosaurs began turning the world over to flowers. Dinosaurian overgrazing threatened many low-growing plants with extinction—except for the angiosperms. Their reproductive superiority helped flowering plants compete with the munching jaws of oblivion.

In turn, this contagion of angiosperms must have had an enormous impact on the dinosaurs' diets. Could it be linked to their mid-Cretaceous extinction?

Certainly new dinosaurs evolved in the aftermath. The late Cretaceous saw duckbill dinosaurs prowling the swamps and forests. On the more open plains, especially in western North America, great herds of rhino-like *Triceratops* and their relatives fed on the new vegetation. Back then a vista across the Dakotas would have resembled a saurian version of today's Serengeti Plain. The lion of that world was the infamous *Tyrannosaurus rex*.

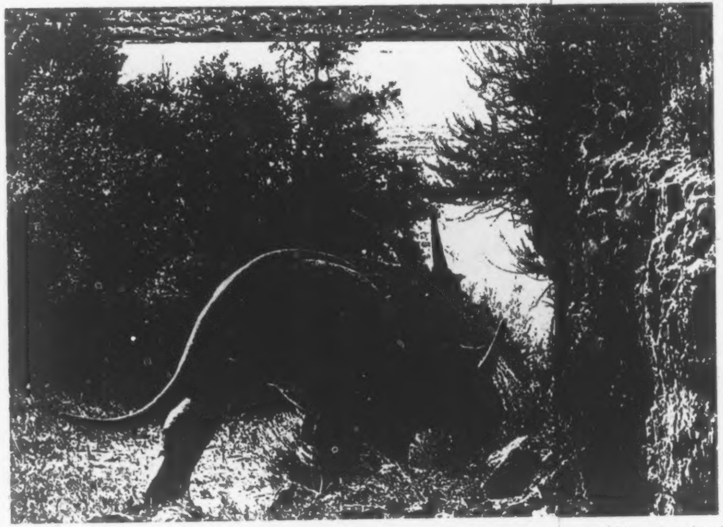
In all, at least 30 genera of dinosaurs—perhaps a hundred species—inhabited the planet during the final ten million years of the Cretaceous. Some specialists argue that most persisted right up to the K-T boundary. Others brandish data indicating that all but 13 genera had perished well before the Cretaceous ended. Recent, hotly contested evidence suggests nine genera of dinosaurs may have straggled on into the following Paleocene epoch. Part of the answer to this debate lies buried in the badlands of the Great Plains.

Ten thousand years ago in the badlands, runoff from the last glaciers cut through the purplish gray and green soils of the Hell Creek formation near the North Dakota-Montana border. As those eroding streams carved buttes out of the vast flatlands, they cut through and exposed for future geologists the last two million years of the Cretaceous period. Hell Creek is the only place on earth that preserves in

***FIRE OR ICE?* Based on his studies of the fossil record, paleobiologist Steven Stanley of Johns Hopkins University (above) believes that global cooling explains most mass extinctions. He holds a Spondylus, a tropical bivalve that died out some 3 million years ago. At the other end of the spectrum, David Raup and Jack Sepkoski of the University of Chicago share the limelight with their theory that mass extinctions occur every 26 million years, perhaps as a result of periodic bombardment by comets.**

detail—with iridium and an abundance of fossils—the dying days of the dinosaurs.

On this July morning the bleak buttes are speckled by the colorful T-shirts of scientists and volunteers sent by the Milwaukee Public Museum. Hammering and chiseling under a blazing badlands sun, Claudia Berghaus, Joan Mathys, and Carol Moertl extricate fragments of a *Triceratops* front leg bone. Doug Stephenson is perched higher up the butte, near the K-T boundary, working on scraps of a scapula.



"I can't get over it," says Jay Warner, who is usually an engineer. "Back in Milwaukee I was worried I wouldn't find a single bone. I found a piece of a turtle in my first five minutes, a dinosaur in ten."

"We want to know what the pattern of diversity was," explains the museum project's coordinator, Peter Sheehan. "It has not been adequately shown that dinosaurs already were dying out before the impact. We're trying to eliminate one of the two possibilities—the whimper or the bang. A gradual pattern of decline is not what you'd expect if an asteroid killed them."

Sheehan contends that past estimates of dinosaur diversity are biased: The better-known North American fossil sites have been mined more thoroughly than other spots. Dale Russell of the National Museums of Canada says dinosaur diversity in North America did not change significantly before the boundary. In central Asia, another dinosaur-rich area, it increased, while much of the world remains poorly sampled.

In the past, fossil hunters usually collected only museum-quality specimens. They ignored the scraps, which may be the most valid indicators of the real abundance of late Cretaceous life.

The scrap that creates the most excitement on this day is not dinosaurian, nor even reptilian.

"We've got a mammal," announces museum paleontologist Diane Gabriel, bending over her sliver of a discovery, a jawbone from a marsupial. "It was probably slightly larger than a chihuahua. That means it was a giant for its time."

MAMMALS are rare in these late Cretaceous rocks, but in the eyes of the Minnesota paleontologist Bob Sloan they are far from insignificant. Sloan believes that 200,000 years before the K-T boundary a receding sea level had created a land bridge between North America and the long-isolated Asian continent. A plague of little Asian mammals invaded North America and began eating the same flowering plants that most dinosaurs ate.

"The mammals ate much less food per animal," says Sloan. "But there were so many of them. They ate the last of the dinosaurs out of house and home." Others suggest the dinosaurs' nemesis was a climate-induced change in vegetation.

In fact, the dinosaurs and their huge flying cousins, the pterosaurs, were among the few land-based animals to go extinct at the end of the Cretaceous. Turtles, crocodiles, many lizards, and most mammals made it through, perhaps because they did not eat much and were small enough to find refuges.

The cruelest K-T extinctions struck the seas. Most plankton, the primary food source, died out—understandable if months of darkness or global acid rain followed an impact. All large marine reptiles also vanished, as did most denizens of the seafloor. Rudists, huge coral-like clams whose shells built Cretaceous reefs, were obliterated. Ammonoids—lovely, coiled survivors of many past extinctions—died out completely.

Not all these creatures disappear from the fossil record right at the

A SPIKED COLLAR and a rhino-like horn helped Styracosaurus (left) fend off his number one enemy—Albertosaurus, a scaled down version of T-rex who stalked the late Cretaceous coastal swamps in what is now Dinosaur Provincial Park in Alberta, Canada. The Tyrrell Museum's lifelike replica is modeled on fossils found in the park.

Whatever caused the extinction at the end of the Cretaceous, this vegetarian cousin of Triceratops wasn't around to see it. Styracosaurus disappeared from the fossil record some 12 million years before the K-T boundary.

K-T boundary. Some vanish earlier in steps. Thus other scientists argue that the K-T impact was not the cause of the dyings. "Ecosystems were decaying for at least two million years before the impact," explains paleontologist Steven Stanley of Johns Hopkins University.

Stanley, a prominent theorist, sees long-term cooling as the culprit. Yet there is no obvious reason for such cooling. The next ice age was tens of millions of years away. Massive volcanic eruptions may have dropped global temperatures temporarily by injecting particles into the atmosphere that blocked sunlight. Indeed, one of the greatest outpourings of lava the world has known occurred at the K-T boundary. This basalt flow buried the Deccan region of India. However, many volcanologists doubt that the relatively calm nature of lava eruptions would propel much debris into the upper atmosphere.

Whatever cooled the planet, Stanley contends that the impact at the boundary probably was but a final insult to an already overstressed global ecosystem.

As I was told by another paleontologist: "Things got bad, then they got worse."

Impact enthusiasts have recently come up with a way to explain the multiple stages of K-T extinctions. Earth, they argue, was hit not by one great object but rather by a shower of comets that bombarded the planet over several million years.

Erle Kauffman of the University of Colorado finds evidence for wild disarray in ocean chemistry beginning two million years before the boundary. Those disruptions, he argues, were created when comets struck the seas, generating tsunamis and overturns of deep anoxic or toxic water like those suggested for earlier extinctions. Those oceanic events also could have created global climate crises far worse than El Niños we experience today. The final terminating impact, says Kauffman, probably occurred on land, where it produced fire storms, soot, and a pall of dust.

One major question surrounds the final impact. Where's the crater? Craters are not always obvious.

"The largest impact and the largest extinction in the past hundred million years occurred at the same time as the largest extrusion of lava," observes geologist Michael Rampino of New York University. "That's quite a coincidence." He and others suspect that the object struck India, thereby causing the great Deccan basaltic lava flows.

If Rampino is right, the K-T crater would be buried beneath the basalt.

Or consider the quiet farm town of Manson, Iowa. It sits over the center of a 32-kilometer-wide crater that glaciers filled with debris during the last ice age. Thus today the only striking feature of Manson is its tall grain elevators. Geologists, however, have recently dated the crater below Manson at 66 million years—perfect timing to make it the K-T killer.

Most scientists agree that 32 kilometers is much too small to create the havoc envisioned by impact enthusiasts. But some suspect Manson's crater may be larger. The 32-kilometer hole may be just an inner pit.

Of course, the impact may have struck the ocean. If so, the scarred seafloor could have been buried by sediments or been recycled into the planet's innards by plate tectonics.

TERROR *of the trilobites,* **Anomalocaris** *(above, at center) did not last long, but many a trilobite shows wounds attributed to the predator. It was extinct by the end of the Cambrian, whereas trilobites hung on until the Permian mass extinction. The fossil of a Jurassic fish covered with armorlike scales is removed from a West German quarry (facing page).*

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PERHAPS more controversial than the impact hypothesis itself is the notion that such showers occur regularly. Jack Sepkoski and David Raup of the University of Chicago have combed a century and a half of fossil record keeping and found a pattern. They see peaks of extinction about every 26 million years. Such regularity implies a cosmic driver to the extinctions. No known earthly mechanism keeps such good time.

Many scientists dispute Raup and Sepkoski's statistical methods; many concur, seeking astrophysical explanations.

The most obvious source for the calamities would be the dense cloud of comets that astronomers believe surrounds the outer solar system. Something could periodically unsettle that cloud, flinging a battalion of comets toward the inner planets over several million years.

Three mechanisms have been proposed. A dense, dark companion star orbiting our sun would toss out comets as it passed through the cloud. So might an unknown, tenth planet. Thirdly, our solar system moves periodically up and down through the star-dense spiral of our Milky Way galaxy. Perhaps our comet envelope is perturbed each time we pass through that spiral arm.

Astrophysicists find dynamical problems with all three mechanisms. Many argue that the showers strike randomly, not regularly. Others see a frequency not of 26 but of about 30 million years.

LAID LOW by the hand of man, the woolly mammoth appears to live again in a diorama presented at the Royal British Columbia Museum in Victoria. Museum technician Wally Bishop checks the musk-ox hair that covers this 11-foot replica, modeled after the beast that ranged over North America, Asia, and Europe during the Pleistocene. Many scientists believe the mammoth, like most of the epoch's megafauna, was hunted to oblivion in Europe and Asia, then became extinct as Ice Age hunters invaded North America across the Bering land bridge.

Both spacings fit the next era of extinctions, which hit between 35 and 40 million years ago. Those dyings eliminated herds of rhino-like mammals and many sea creatures. Although iridium spikes correlate to some of these die-offs, gradualists argue that a well-documented chilling of the seas did the killing.

Advocates of the 26-million-year period point to a mild extinction around 14 million years ago as evidence for the most recent bombardment. That places us today safely between showers. Those favoring 30-million-year or random spacing are less sanguine.

Michael Rampino points to three large craters—Bosumtwi in Ghana (10.5 kilometers in diameter) and two in the Soviet Union, Elgygytgyn (23 kilometers) and Zhamanshin (13 kilometers)—that were created in the past 3.5 million years.

"We could still be in a shower," says Rampino. "Halley's comet could be part of it. We aren't out of the woods yet."

Intriguing debris from the impact of a large celestial object 2.3 million years ago has recently been found strewn across some 600 kilometers of the Pacific seafloor off Cape Horn.

"About 2.3 million years ago there was an abrupt shift in climate," notes geologist Frank Kyte, leader of the University of California at Los Angeles team that discovered evidence of the impact. "Huge continental ice sheets developed in the Northern Hemisphere."

Kyte notes that the climate had been deteriorating before this, our most recent ice age, set in. But he speculates that the injection of water vapor into the stratosphere could have formed a global cloud cover that reflected heat off the top of the atmosphere.

"No one would argue that impacts alone cause ice ages," adds Mike Rampino. "But might they push the climate into a new state?"

WHETHER OR NOT we fit a cosmic timetable for an extinction, we surely are in one today.

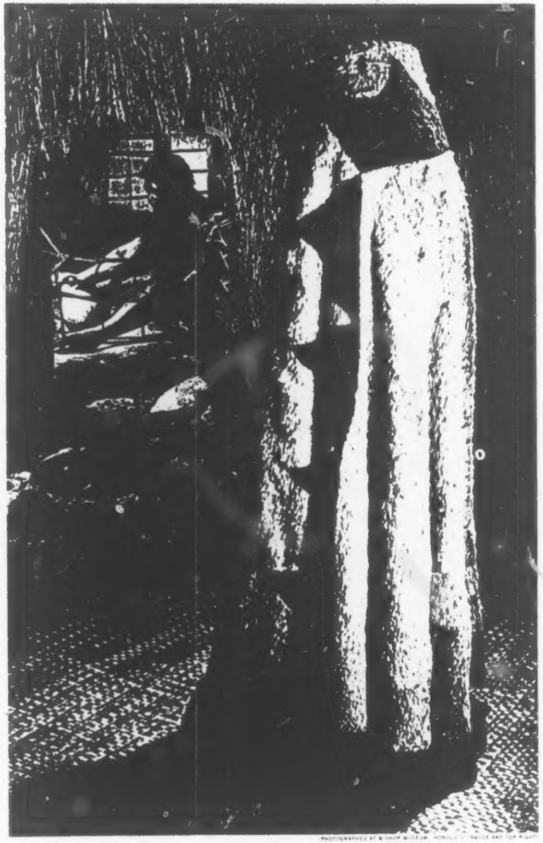
It began in North America about 11,000 years ago. Most large mammals were wiped out. Saber-toothed cats, mastodons, mammoths, huge ground sloths, short-faced bears, and dire wolves. All perished abruptly. What happened?

Some scientists argue that the climate grew drier. In western North America arid conditions dried up the food supply of large herbivores. As the herbivores disappeared, so did the carnivores that preyed on them.

The extinctions, however, were so rapid—within five hundred to a thousand years—that many scientists suspect an alternate—or at least assistant—villain in this extinction: *Homo sapiens*. Man the hunter emerged from the Ice Age with lethal new hunting technologies—snares, traps, and sharp-pointed weapons.

Today the impact of human technology on the biosphere worsens. It exterminates not just the big creatures but the tiny. Man has become an asteroid. A very big one.

It is easy to blame today's frightful extinctions on habitat destruction in developing countries. To be sure, the crisis is acute in Brazil and Madagascar and the Philippines, where rapidly expanding populations



PHOTOGRAPHED AT BISHOP MUSEUM, HONOLULU (ABOVE AND TOP RIGHT)

and the need for economic development can erase a forest in weeks.

"They are losing their inheritance," says botanist S. H. Sohmer at the Bishop Museum in Honolulu. Just back from the Philippines, where he is helping local biologists bolster national awareness of the problem, Sohmer paints a dismal picture.

"In the plant group I study, 42 percent of the species reported in 1930 have not been collected since," he says. "The leveled forests are often replaced by an aggressive plant called cogongrass. If the logging and slash-and-burn agriculture don't stop soon, we'll wind up with entire islands covered by it. Conceivably this archipelago, which once had one of the world's richest biotas, will end up with only a handful of species."

It is easy for the wealthier countries to decry and then ignore these habitat losses. But we have only to ask who buys the timber or beef these felled forests produce. Or who generates the acid rain that is wiping out New England's sugar maples or West Germany's Black Forest.

The United States can look at Hawaii, which most of us regard as paradise but which biologists consider the endangered-species capital of the world. Though occupying less than 0.2 percent of the nation's landmass, Hawaii contains 27 percent of its endangered birds and plants. Seventy-two percent of those U. S. species that have already become extinct did so on these islands.

IN THE ALAKAI SWAMP on the island of Kauai a male 'o'o-'a'a sings his melancholy song alone.

"He's the best songster in the islands," says state aviculturist Fern Duvall. "His call is unforgettable, like the flutes of the old Hawaiians."

For the past three years the mating calls of the 'o'o have gone unheeded. For he is the last of his species, the end of the line.

"We've lost not only a species," says Duvall, "but its entire family—all the honey eaters will be gone."

Meanwhile, in Honolulu's Bishop Museum schoolchildren file past the celebrated yellow feather cape of King Kamehameha I. The cape was assembled from the plumage of the lost honey eaters in the late 18th century.

"It took the feathers from 80,000 birds to make this cloak," says their guide.

Many Hawaiian birds were flightless. Before humans the islands knew no mammalian predators, and wings grew less useful. Thus when humans brought rats and dogs, native birds and eggs were easy prey. Imported goats, pigs, and cattle ravaged avian habitats. Humans felled their forests.

In a dark lava tube on the island of Maui ornithologists Storrs Olson and Helen James of the Smithsonian Institution excavate soils deposited during the past 8,000 years. A dark layer high in the soil strata

***PRIZED** for its plumage, the Hawaiian 'o'o-'a'a (top) was overhunted to adorn cloaks like one worn by chief Kiwala'o (facing page). After studying the fossil record in Maui's lava tubes, Helen James of the Smithsonian Institution (above) rates predators introduced by Polynesians—pigs, dogs, and rats—as more deadly agents of extinction.*

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Mr. SMITH. Also I have a question for Mr. Leonard, and let me make a confession that the Chairman of the committee might be interested in as well as Mr. Leonard.

That is that many years ago, long ago and far away, I took the first forestry course offered to an undergraduate at the college that I attended, and as a result of that course came within an inch of choosing to be a wildlife naturalist as my life's career rather than getting pulled towards the direction that I ended up taking. I won't say which is better. I think both can be argued.

I might also add that—and I am really getting off the track here, Mr. Chairman—that John Adams, the second President of the United States——

Mr. SCHEUER. Excuse me, Congressman. My staff advises me that this subcommittee offers you a chance to play both roles.

Mr. SMITH. Very true, Mr. Chairman. Thank you.

I started to say in regard to the path not taken or perhaps the path taken, that John Adams, the second President of the United States, once described choosing the profession of politics as very similar to taking a road through a swamp, that there was only one place to get off and that that was at the end. So it explains why perhaps I am here and not a wildlife naturalist.

But my question is this: The old-growth forests in the Pacific Northwest have recently received a lot of news coverage, and the issues pertain directly to the subject we are addressing today. How does the Forest Service management of the old-growth forest affect the conservation of biological diversity?

Mr. LEONARD. Congressman Smith, the management of our old-growth forests in the Northwest is indeed a controversial issue. At the moment it is one with very significant ecological and biological dimensions and also very significant economic dimensions because we have a large industry out there in the Northwest that is dependent on harvesting old-growth timber.

The Forest Service recognizes that the old-growth ecological community is a very vital part of maintaining biological diversity in this country. And it is essential that we maintain a good representation of old-growth timber in all its variability across the spectrum of the forests in the Pacific Northwest. And we are doing this, and we intend to continue.

We have large areas of old-growth timber, and we are really talking primarily about timber in the Douglas fir subregion of Oregon, Washington and northern California. We have large portions and samples of that ecosystem in our national parks in our wilderness areas, in research natural areas and in other areas that will not be subject to timber harvesting at any point in the future.

The real question is how much do we need to maintain in these protected areas and how well we can manage the areas that are currently planned for timber production to maintain biological diversity in those managed areas?

The question is when we cut a stand of old growth, we change the biology, the makeup of the plant and animal communities in that area. It doesn't necessarily result in a reduction in biological diversity. At various stages in the development of a stand of trees, we will actually enhance biological diversity. But we definitely change it.

So we see management for old-growth-dependent species where plant and animal has a very important part of our change on the national forests, and in our current round of land management planning we are attempting to meet that responsibility.

Mr. SMITH. Dr. Leonard, thank you.

Mr. Chairman, I don't have any other questions.

Mr. SCHEUER. Thank you very much, Congressman.

We are finished for the afternoon over there on the Floor, so we can proceed uninterrupted through the duration of the last panel.

This was an excellent panel. I thank you very much, all of you. We will look forward to working with you in the weeks and months ahead. And we will very much value any comments and suggestions you may have on this legislation.

Thank you very, very much.

We will now move to panel three: Dr. Rupert Cutler, president of Defenders of Wildlife; Mr. David Ford, Government affairs of the National Forest Products Association; Mr. John Heissenbuttel, manager for research and policy of the American Forest Council; and Dr. Don Waller, associate professor of botany, University of Wisconsin, testifying on behalf of the Sierra Club.

Well, we welcome all of you. Each of you will be invited to testify for about five minutes. And we hope that you will liberate yourself from the printed page and just tell us informally what your views are, what your counsel and advice is, and don't hesitate to refer to any of the exchanges you have heard today.

Your full testimony will be printed at this point in the record at which you testify.

So let's start with Dr. Rupert Cutler.

STATEMENT OF DR. M. RUPERT CUTLER, PRESIDENT, DEFENDERS OF WILDLIFE

Dr. CUTLER. Thank you very much, Mr. Chairman. I am Rupert Cutler, president of Defenders of Wildlife, a 40-year-old, 80,000-member, private nonprofit wildlife conservation group.

I have been working for that period of time on behalf of biological diversity. But a decade ago I was wearing another hat, that of assistant secretary of agriculture for conservation, research and education, and in that capacity responsible for the Forest Service and several other Department of Agriculture agencies.

In that capacity I appointed a committee of scientists under the requirements of the National Forest Management Act to write the regulations, still in force, to preserve biological diversity in the national forest system. As a result, the Forest Service today has a great amount of experience in attempting to protect biodiversity.

Unfortunately, however, the Forest Service still has a long way to go in giving more than lip service to that goal. And attention to it just won't happen until its regional foresters, forest supervisors and district rangers are held just as accountable for the successful reproduction of rare wildlife species on the lands they administer as they are held accountable for meeting timber sale targets.

In short, sir, the reward system for the local administrators of Federal public lands still is skewed in favor of quantifiable commodity production targets, and they receive relatively little encouragement from their superiors to preserve rare plants and animals and beautiful, ecologically healthy landscapes. And until we figure out how to put wildlife conservation, watershed stability and biological diversity protection goals on a par with timber and forage output goals when forest rangers, TVA employees and others are evaluated for raises and promotions, their programs will remain out of whack.

Just how you get at that problem through legislation might be worthy of your investigation. It may involve the Office of Personnel Management and new personnel evaluation and reward systems.

Defenders of Wildlife strongly supports passage of your bill, H.R. 1268, and will devote its energies, through contacts by its 8,500 volunteer activists with their Members of Congress, to try to effect its prompt passage.

We do have a few suggestions for amendments. In statutes already on the books, the Congress has urged agencies to consider biological diversity and even "required" its consideration in planning and programs.

Too often, however, we have seen a lack of accountability in terms of deadlines, standards and effective third-party enforcement mechanisms. Their absence has turned these so-called policy statements by the Congress into relatively impotent pleas that are ignored by the agencies with impunity.

For example, section 5(a) of the Endangered Species Act requires the Secretary of the Interior and the Secretary of Agriculture to develop and implement a conservation plan for wildlife, fish and plants, including but not limited to endangered and threatened species. But if that has been done, we are not aware of it.

Section 4 of the Endangered Species Act requires recovery plans to be developed and implemented, yet many so-called listed species have no recovery plan, and those recovery plans that do exist are not being implemented.

Section 7(a)(1) of the same Endangered Species Act requires all Federal agencies to implement programs for the conservation of endangered and threatened species. Yet, few agencies other than the land management agencies have active wildlife conservation programs.

Similar assessments can be made of other related statutory tools such as the "areas of critical environmental concern" language in the Federal Land Use Policy and Management Act, the BLM organic act.

The main reason for this inaction is that Congress provided neither deadlines nor opportunities for third-party enforcement nor other means of holding the agency's feet to the fire. Therefore, when presidential appointees without enthusiasm for this charge are in command, efforts to preserve diversity dwindle or cease altogether.

This subcommittee, its Chairman, and the sponsors of this bill are to be congratulated for responding to the need for a comprehensive approach to the protection of native wild species, their genetic integrity and diversity and the intact ecosystems on which they depend.

These are the basic building blocks of life. This is what is at stake if we do not act.

Our specific suggestions for amendment, very briefly, are as follows:

Section 2, findings: The section should be shortened. Much of it can be moved to the Committee Report;

Section 3, definitions: The definitions are broad. Research should be broad in scope, but overly broad standards are unenforceable. Without precision in the law itself or in regulations required by a certain time and by a certain official, another set of advisory guidelines will create considerable frustration and disappointment;

Section 5, policy: This section is key, 5(c) in particular. First, I suggest that in 5(a) you strike the word "efforts", for it is conservation and not efforts toward it that is the goal.

We applaud your global approach in section 5(b). The Office of Technology Assessment report ignored the applicability of the Endangered Species Act to U.S. actions affecting species overseas and treated it only as a domestic law. But by its own terms it is not, and neither should this law be, for there are practical ways we can address the problem. Biology knows no national borders, just as pollution knows no political perimeters;

Section 5(c) may be the most important sentence in the bill. It is similar to section 7(a)(2) of the Endangered Species Act which provides essentially that no Federal agency action shall jeopardize the continued existence of a species that the Secretary of the Interior has found to be endangered or threatened or result in the destruction or adverse modification of the habitat that the Secretary has declared to be critical to such a species' survival.

If the term biological diversity is defined in the bill or regulations in an objective, measurable and practical way, and if citizens can sue to enforce this law and, in particular, this subsection, then the policy will be heeded.

Sections 6, 7 and 8 concerning the Center, the interagency working committee, and the strategy could be consolidated. And it may be best to place the Center, if any, in the Environmental Protection Agency;

Section 9 on grants: The grant program is a good idea, but too little money is authorized to make an impact. Unique research that is not single-species-specific should be encouraged;

Finally, the relatively small size of the suggested appropriation authorization proves the point that we cannot hope to conserve our ecosphere through spending programs alone. Given the trillions of dollars being spent around the world on actions that generally reduce diversity, we need legal and scientific tools to channel that greater spending and more responsible life-sustaining ways. We recognized early in this century when land-use planning and regulation were implemented by State and local Governments that responsible behavior by Federal agencies are the only ways that we can end the loss of biological diversity in the long run.

In summary, Mr. Chairman, ecosystem conservation cannot be the part-time job of just a few agencies. It must be inherent in all Government policy planning and action. The preservation of genetic resources is the most fundamental element of conservation strategy. To be less conservative is to run the radical risk of eliminating not just the odd species here and there but of eliminating the ability of Earth to sustain life at all.

Thank you, Mr. Chairman. I would be happy to respond to your questions.

[The prepared statement of Dr. Cutler follows:]

Defenders
OF WILDLIFE

TESTIMONY OF
M. RUPERT CUTLER, Ph. D.
PRESIDENT, DEFENDERS OF WILDLIFE
BEFORE THE
SUBCOMMITTEE ON NATURAL RESOURCES,
AGRICULTURE RESEARCH AND THE ENVIRONMENT
OF THE
COMMITTEE ON SCIENCE AND TECHNOLOGY
U.S. HOUSE OF REPRESENTATIVES
ON H.R. 1268
THE NATIONAL BIOLOGICAL DIVERSITY CONSERVATION AND RESEARCH ACT
MAY 17, 1989

1244 NINETEENTH STREET, NW • WASHINGTON, DC 20036 • (202) 659-9510

Mr. Chairman, I am M. Rupert Cutler, President of Defenders of Wildlife, an 80,000-member nonprofit environmental association headquartered in Washington, D.C. Our purpose is to provide for the protection of all native wildlife species and their habitats.

As Assistant Secretary of Agriculture during the Carter Administration, I was the official responsible for the drafting, adoption, and implementation of regulations intended to preserve biological diversity within the National Forest System as required by the National Forest Management Act of 1976. Today, as President of Defenders, I lead an organization long devoted to the preservation of biological diversity. Therefore, I am very appreciative of this opportunity to testify before you today in strong support of H.R. 1268, legislation designed to direct federal agencies to make the conservation of biological diversity one of their ongoing responsibilities, if the bill is amended along lines I will suggest.

In statutes already on the books, the Congress has urged agencies to consider biological diversity and even "required" its consideration in planning and programs. Too often, however, we have seen a lack of accountability in terms of deadlines, standards, and effective third-party enforcement mechanisms. Their absence has turned these "policy" statements by the Congress into relatively impotent pleas that are ignored by the agencies with impunity.

For example, Section 5(a) of the Endangered Species Act (ESA) requires the Secretary of the Interior and the Secretary of Agriculture to develop and implement a conservation plan for wildlife, fish, and plants, including but not limited to endangered and threatened species. If that has been done, we're not aware of its existence. Section 4 of the ESA requires recovery plans to be developed and implemented, yet many "listed" species have none, and those recovery plans that do exist are not being fully implemented.

Section 7(a)(1) of the same Act requires all federal agencies to implement programs for the conservation of endangered and threatened species, yet few agencies other than the land management agencies have active wildlife conservation programs. Similar assessments can be made of other related statutory tools, such as the "Areas of Critical Environmental Concern" language in the Federal Land Use Policy and Management Act. The main reason for this inaction is that Congress provided neither deadlines nor opportunities for third-party enforcement nor other means of holding the agencies' feet to the fire. Therefore, when presidential appointees without enthusiasm for this charge are in command, efforts to preserve diversity dwindle or cease altogether.

This Subcommittee, its Chairman, and the sponsors of this bill are to be congratulated for responding to the need -- proclaimed by many of us and well documented by the Office of Technology Assessment (OTA) -- for a comprehensive approach to the protection of native wild species, their genetic integrity and diversity, and the intact ecosystems on which they depend. These are the basic building blocks of life. That is what is at risk if we do not act.

The action we take must be effective as well as conceptually sound. We need to develop a workable and enforceable system, with standards that can be improved as our knowledge improves, but that serves to conserve these resources today. If we are unsure of how to create enforceable standards to protect biological diversity beyond those existing in law, we should at least create a process that will enhance and expedite the implementation of existing conservation programs and provide for the enforcement of existing standards. Although it may seem obvious, we should specifically note that what we do in this process is in addition to current requirements in law and not an alternative or a reduction in duties under such statutes as the Endangered Species Act and the National Environmental Policy Act, given the predilection of the Bush Administration so far not to advance many environmental standards.

Last year Defenders of Wildlife urged passage of H.R. 4335 if it were streamlined and if its provisions were recast to provide for more accountability and ease of enforcement, with the encouragement of outside parties if necessary.

Our suggestions for amending H.R. 1268 are as follows:

Section 2. FINDINGS: This section should be shortened. Much of it can be moved to the Committee Report. The report should direct that implementation should include assessments of the health of interrelationships of "biotic" and "abiotic" systems and associated nutrient chains.

Section 3. DEFINITIONS: The definitions are broad. Research should be broad in scope, but overly broad standards are unenforceable. For example, consider a federal action that would eliminate a measurable or statistically significant portion of the gene pool of a given subspecies or eliminate a small wetland which is by definition different from any other. Would that be considered inconsistent with the goal of conservation of biological diversity? It is not entirely clear whether the inclusion in Section 5(c) of the phrase, "to the extent practicable" solves the problem, or whether we should be more precise in defining "practicable".

Should we attempt to protect all living things? Probably not disease microorganisms, but where do we draw the line? Our definition of pests has changed rapidly as we have begun to understand the workings of nature. The Federal Animal Damage Control Act still calls for the eradication of predators such as wolves. It has been superseded by the listing of wolves as endangered and threatened species, but that has not restored the predator-prey balance to many of our ecosystems.

How inconsistent with the general policy would actions have to be before they could be stopped? We have numerous advisory guidelines that are sometimes helpful but often simply ignored. Without precision in the law itself, or in regulations required by a certain time and by a certain official, another set of advisory guidelines will create considerable frustration and disappointment.

One solution might be to require the assessment of the impact of proposed federal actions on all species and ecological communities and prohibit degradation that may significantly decrease the viability of species or ecosystems unless the Interagency Committee grants an exemption in the manner of the so-called "God Committee" established in Section 7(g) of the ESA. Such an exemption process could be copied from the ESA and used in this bill. This statutory direction should be given in Section 5.

Section 4. PURPOSES: One of the purposes is to establish a strategy; another is to establish coordination. I suggest you add "and standards" after "strategy" if you want standards to be developed that control actions.

Section 5. POLICY: This section is key -- 5(c) in particular. First, I suggest that in 5(a) you strike the word "efforts" for it is conservation and not efforts toward it that is the goal.

We applaud your global approach in Section 5(b). The OTA report ignored the applicability of the Endangered Species Act to U.S. actions affecting species overseas and treated it only as a domestic law, for example. By its own terms it is not, and neither should this law be, for there are practical ways we can address the problem. Biology knows no national borders, just as pollution knows no political perimeters. We must recognize that, unless we look beyond our ecosystems and control our effects on the ecosphere, we will not only accelerate extinctions here, but we will negligently continue to export forces leading to extinctions elsewhere.

In that regard, we greatly appreciate the letters of Chairman Scheuer in support of our recent court victory in Defenders of Wildlife v. Hodel (February 15, 1989 U.S. Dist. Ct. Minn.) in which the court held that the Endangered Species Act does control what our own agencies do to listed wildlife overseas. Unfortunately, the Bush administration is appealing that decision rather than implementing it.

Section 5(c) may be the most important sentence in the bill. It is similar to Section 7(a)(2) of the Endangered Species Act, which provides essentially that no federal agency action shall jeopardize the continued existence of a species that the Secretary of the Interior has found to be endangered or threatened, or result in the destruction or adverse modification of habitat that the Secretary has declared to be critical to such a species' survival.

If the term "biological diversity" is defined, in the bill or in regulations, in an objective, measurable, and practical way, and if citizens can sue to enforce this law and in particular this subsection, then this policy will be heeded. This might be done using the "significantly decrease viability" test I outlined above, meaning statistically significant, and not the larger "substantial" or other more amorphous term. We recognize the attempt to do this as you have retained broad definitions but limited their impact to "practicable" constraints. Too often however, "practicable" is a loophole unless we define it to mean any step that could provide a substantially similar result through any other means, policy or medium that is technologically possible or using the best available technology. This clearly deserves further discussion.

If the Congress chooses not to enact an enforceable standard in any case, then it would be more forthright to require simply that the agency record show how biological diversity was considered in the development and implementation of agency actions.

As you know, Mr. Chairman, we are at a critical point in the evolution of public policy on this matter, and that is why we are here today. Defenders has pressed the effort to halt extinction through enforcement of the Endangered Species Act. That act provides protection only after species are listed. The listed species have clearly been helped, but less than two dozen are demonstrably on the road to recovery. In 1985, nearly 300 species that had been awaiting listing were declared by the Secretary to be extinct or possibly extinct. This is almost a third as many as had been listed. Though roughly a thousand are listed, nearly as many warrant listing but have not been, and twice as many are official candidates for further analysis. Some experts say that we may be losing more than a species a day as a result of humankind's direct or indirect degradation of the natural environment.

Section 5(c) is intended to require federal agencies to anticipate the effects of their actions on all species and habitats and design those actions so that species or genetic diversity within species will not be degraded. Unlike the protection from "taking" afforded listed species by the ESA, however, it would not rule out the killing of any species. Therefore, it would not protect biological diversity from the actions of non-federal entities.

Section 5(d) may not be necessary, since it is clearly within the scope of the National Environmental Policy Act (NEPA). However, such a statutory requirement, even if redundant, would help ensure that the assessment is carried out and the deletion of "any" impact in this year's bill is probably a good and practical step.

The new Section 5(e) is a good review process but it undercuts 5(c). In line 18, I would add after "reduce" the words "and eliminate" and in (C) online 21, the words "supporting and justifying..." and following should be replaced with "explaining any continuation recommended by the agency head of the program elements which have adverse effects on biological diversity." Unless these changes are made, you may send the signal that adverse effects are okay as long as they are rationalized according to an agency head's subjective weighing of what appear to be conflicting objectives.

Either in Section 5 or in a separate section the Congress should provide that any person may bring an action in federal court to enforce any requirement of the Act. Attorneys' and expert witnesses' fees and costs should be awarded any substantially prevailing plaintiff.

Sections 6, 7, and 8, concerning the Center, the Interagency Working Committee, and the strategy, could be consolidated. To assure the institutional ability and accountability necessary, responsibility for the work envisioned in these sections should be assigned to one federal official. That official should be responsible for those functions proposed for a Center that are not already now underway. (We are not convinced of the need for a new Center as such.) That official should chair the Interagency Committee as well. It may be best to place the Center, if any, in the E.P.A.

The Interior Department's Fish and Wildlife Service has responsibility for protecting biological diversity under the ESA, the Fish and Wildlife Coordination Act, the Fish and Wildlife Conservation Act, the Sikes Act, and numerous other statutes and conventions. This gives the Service experience with assisting in the preservation of diversity here and abroad by controlling the impact of agency actions on the biotic community beyond federal lands, both here and, under the ESA, abroad. Any center should review and work closely with the Service therefore.

Federal efforts in this vein to date have been insufficient. Yet we should not duplicate the existing efforts of public and private entities such as the Interior Department, the Smithsonian, The Nature Conservancy, and the state Natural Heritage Programs. The proposed Interagency Committee is an excellent idea. It should include the State Department, but should be chaired by the Secretary of the Interior.

The strategy envisioned in Section 8 would be helpful. It should address the effect of federal grants, as suggested, but also include loans, insurance guarantees, technical assistance, and taxes among the federal actions that may affect biodiversity. Paragraph (15) should be added to subsection (a) so that it is clear from the outset that the strategy is to be global and that concern for the effects of actions on species overseas is not just an afterthought.

The strategy must incorporate assessments of habitat fragmentation and use the concepts of island biogeography to help counteract habitat loss. These should include the preservation through acquisition, easements, and land use regulation of both large habitat areas and undeveloped corridors between major habitat areas.

Defenders is seeking appropriations for the Interior Department, its Cooperative Research Units, and other agencies to develop such a strategy and program under current law, including but not limited to Section 5(a) of the Endangered Species Act.

The strategy should emphasize techniques that do not depend on perpetual manipulation. It must bring the concepts of sustainability and ecosystem integrity to the forefront in land management and planning. This is simply the old rule of stewardship and sustained yield, supported by the increasingly detailed understanding of ecological relationships.

Section 9. GRANTS: The grant program is a good idea, but too little money is authorized to make an impact. Unique research that is not single-species-specific should be encouraged.

On March 15, 1988, I submitted testimony before the Merchant Marine Committee's Subcommittee on Fisheries, Wildlife Conservation and the Environment on amendments to the Fish and Wildlife Conservation Act (FWCA) of 1980. H.R. 1268 has also been referred to that Subcommittee. The purpose of the FWCA is to provide grants for the conservation of "nongame" wildlife to those states whose plans and capabilities meet standards to be developed by the Fish and Wildlife Service. My testimony recommends a funding level of $50-100 million, preferably from the portion of the highway trust fund attributable to taxes on gasoline not used on highways. I also recommended broadening the program to encourage comprehensive wildlife management for all species and all major human activities affecting them. The grants envisioned in the biodiversity bill could be combined or run in conjunction with the FWCA grants. A copy of my testimony on the FWCA is attached to my written testimony that I am delivering today.

It is also worth noting that Interior's Fish and Wildlife Service administers grants to Cooperative Research Units at universities in 35 states. This program now includes research in the area of biological diversity. (For example, see Species Richness, J. Michael Scott et al. in Vol. 37 of BioScience pp. 782-788. Dr. Scott is the unit leader of the Idaho Cooperative Fish and Wildlife Research Unit.)

The Secretary of the Interior should also be given the authority over the grants program with nominations provided by the Interagency Committee and the Advisory Committee.

Section 10. ADVISORY COMMITTEE: This section need only be amended to reflect changes in other sections.

Section 11. AUTHORIZATIONS: The authorization should be provided to the Department of the Interior for fiscal years 1990 through 1992 because fiscal year 1989 appropriation decisions are being made now.

The relatively small size of the suggested appropriation authorization proves the point that we cannot hope to conserve our ecosphere through spending programs alone. Given the trillions of dollars being spent around the world on actions that generally reduce diversity, we need legal and scientific tools to channel that greater spending in more responsible life-sustaining ways. We recognized this early in this century when land use planning and regulation were implemented by state and local governments. That and responsible behavior by federal agencies are the only ways that we can end the loss of biological diversity in the long run.

In summary, ecosystem conservation cannot be the part-time job of just a few agencies. It must be inherent in all government policy, planning, and action. The preservation of genetic resources is the most fundamental element of conservation strategy. To be less conservative is to run the radical risk of eliminating not just the odd species here and there, but of eliminating the ability of earth to sustain life at all.

Thank you again, Mr. Chairman. That concludes my testimony. I will be happy to respond to questions.

Mr. **Scheuer**. We will most certainly have some questions for you when your colleagues are finished.

All right. Now we will hear from Mr. David Ford, Director of Government Affairs for the National Forest Products Association.

STATEMENT OF DAVID FORD, DIRECTOR, GOVERNMENT AFFAIRS, NATIONAL FOREST PRODUCTS ASSOCIATION

Mr. **Ford**. Thank you very much, Mr. Chairman. My name is David Ford, and I am a representative of the National Forest Products Association. This is my first time appearing before you and your subcommittee, Mr. Chairman, and I would like to make an observation that I am very impressed with the open-minded approach with which you are holding these hearings to really try to get to what the views are of the various folks testifying here today.

Mr. **Scheuer**. Well, we are very keen to get your views, and my suggestion would be for you to transport yourself into my living room, relax, sit back, and schmooz with us and sort of give us a James Joycian stream of consciousness about how you react to this legislation and how you react to anything you have heard today. Don't feel that you have to be limited to the printed page. I am sure you are a very articulate and intelligent guy, so let's just talk, let's just reason together.

Mr. **Ford**. Thank you.

I would like to let you know that our view is in relation to the forest ecosystem. However, the forest ecosystem is only one of the ecosystems throughout the world that there is concern over, and we do agree that greater attention and awareness to the issue of maintenance and enhancement of biological diversity is crucial.

Today there is no single definition of biological diversity that can be agreed upon by scientists. There are numerous definitions. Some are very general, and some are very, very specific. There are at least 28 Federal laws that exist on the books today that deal with the maintenanee of biological diversity. However, none of these laws does provide a discrete definition of biological diversity. Rather, they move to protect certain resource and environmental values which, in part, involve the promotion of diverse ecosystems even though that may not be their specific objective.

The forest products industry believes that consensus must be reached on issues surrounding biological diversity by a variety of interest groups and organizations. And there was a lot of discussion today about the Keystone Center process. We are a member of that Keystone process, and they have, I think, some very positive goals. And that is to build consensus and a definition of biological diversity, identify research and data needs, and recommendations for a coordinated national effort to conserve biological diversity.

The Keystone process does have members of various agencies many of whom were represented here today, including EPA as well as folks from your staff. And that process did just begin in March, just a couple of months ago. And the next session is going to be held, as a matter of fact, I think this coming Monday here in Washington.

There are about 50 folks that are involved in that process. And they range from the Federal agencies, from congressional staff, commodity interest groups like the National Forest Products Association, the Farmers Bureau that represent the farmers of this Nation, the oil and gas, mining, grazing as well as environmental and preservation organizations such as Dr. Cutler who is involved in that process, the Sierra Club, the Wilderness Society and others.

We believe that the national dialogue on biological diversity is a useful process under which consensus on many aspects of this issue may be forged. National dialogues such as this have proven to be successful on complex issues.

For example, the national wetlands policy forum released by the Conservation Foundation that was headed by the now-EPA director Mr. Reilly, the administrator, released in late 1988, presents consensus strategy for conserving America's wetlands. That was a very difficult and complex issue, and they accomplished that task in about a two-year process. So that it is possible.

The forest products industry is concerned that additional legislation passed before consensus is reached on a biological diversity definition will only add to the current complexity of the regulations in place; an overly broad definition of biological diversity would create an opportunity for unintentioned court challenges, as Mr. Leonard spoke of earlier today, on Federal actions, forcing the courts to make interpretations and decisions which should be based on scientific understanding as well as public consensus.

We are very concerned that the courts would make the decisions. As you indicated yourself, Mr. Chairman, that really is an inappropriate place, I think, in both of our views, and that the scientific community really needs to be the ones that work this out.

Many aspects of H.R. 1268 touch on important concepts that should be considered for implementation through existing programs, such as the interagency and additional research.

The forest products industry does not support passage of H.R. 1268, for several reasons:

First, the bill does not provide a precise definition of biological diversity. Using a broad definition in the context of the proposed NEPA amendments will complicate the process under which Federal agencies must now proceed to implement various activities such as timber harvests and wildlife habitat improvement projects. This will result in increased challenges to specific Federal actions on grounds that an agency failed to address some aspect of biological diversity. The courts would then be forced to resolve the issue.

Secondly, the bill would require the administrator of the Environmental Protection Agency to review and comment in writing on the adequacy of each and every environmental impact statement prepared under NEPA in assessing biological diversity impacts. This requirement adds an additional layer of review without any clear benefit. Also, it increases both the time and the costs of completing that action.

We believe the strategy on biological diversity developed through consensus is preferable to a strategy based on legislation.

In conclusion, the forest products industry does not support H.R. 1268 on conservation of biological diversity. We do, however, support efforts to better define what additional knowledge and policy direction is needed to assure the conservation of biological diversity in a fashion that is consistent with other national priorities.

The Keystone Center national dialogue process is a positive way to reach consensus on many aspects of biological diversity issues. We believe this process will be fruitful and will contribute to a collective view for appropriate action in the future.

Thank you, Mr. Chairman.

[The prepared statement of Mr. Ford follows:]

STATEMENT FOR THE RECORD

OF

DAVID FORD

NATIONAL FOREST PRODUCTS ASSOCIATION

BEFORE THE

SUBCOMMITTEE ON NATURAL RESOURCES, AGRICULTURE RESEARCH AND ENVIRONMENT

COMMITTEE ON SCIENCE, SPACE AND TECHNOLOGY

OF THE

UNITED STATES HOUSE OF REPRESENTATIVES

MAY 24, 1989

I. Introduction

Good afternoon. My name is David Ford. I am a professional forester and Congressional Representative for the National Forest Products Association in Washington, D.C. NFPA is a national association of forestland owners and forest products manufacturers. Many of NFPA's members are dependent in whole or in part on national forests or other public lands for their raw material supply. All of NFPA's members are concerned stewards of forestlands whether they are owned by the federal government, forest products industry, or others.

I would like to thank the Chairman and the members of the Subcommittee for the opportunity to testify on H.R. 1268 -- the National Biological Diversity Conservation and Environmental Research Act.

II. Consensus On A Biological Diversity Definition Has Yet To Be Reached

Today, there is no single definition of biological diversity accepted by the scientific community which can be utilized as a basis for legislative or policy discussion. There are numerous definitions; some are general and others are quite specific. There are at least 28 federal laws relating to biological diversity maintenance. None of these laws provide a discrete definition, rather they move to protect certain resource and environmental values which, in part, involve the promotion of diverse ecosystems even though that may not be their specific objective.

III. Diversity Definitions Have Evolved In The Context Of Specific Issues

Over time, many diversity definitions have evolved in an issue specific context, such as the reference to diversity in the National Forest Management Act (NFMA) of 1976. In part, NFMA states " provide for diversity of plant and animal communities based on the suitability and capability of the specific land area in order to meet overall multiple-use objectives." The words "diversity" and "overall multiple-use objectives" were used to address the forest type conversion issue that grew out of the Ozarks during the late 1960's and early 1970's. The legislative record clearly shows that Senator Bumpers intent was to discourage type conversion in the southern forests.

Although many different views of what Congress intended in its NFMA diversity language have been aired since passage of the legislation, the Forest Service chose to implement NFMA's diversity provision through regulations which outlined three management directives: (1) maintain viable populations of vertebrate species through habitat management; (2) measure the effects of management on forest ecology through indicator species; and (3) inventory and monitor wildlife resources. The regulatory emphasis is on protection of diversity consistent with multiple-use objectives. To date, there have been no legal challenges to the regulations.

IV. The Forest Products Industry Supports Efforts To Reach Consensus On Biological Diversity Issues

The forest products industry believes that consensus must be reached on issues surrounding biological diversity by a variety of interest groups and organizations. Currently, the forest products industry is participating in a national dialogue on biological diversity. The intent of the dialogue is to build consensus in three areas: (1) a biological diversity definition; (2) research and data needs; and (3) recommendations for a coordinated national effort to conserve biological diversity.

The Keystone Center, a national non-profit science and public policy and educational organization located in Colorado, is facilitating the national dialogue. The Forest Service initiated the effort during the spring of 1988. Agreement was reached during the fall of 1988 to move forward. The national dialogue on biological diversity began in March and will conclude in mid-1990 with a consensus document. The Keystone Center has a successful track record of facilitating consensus on complex and controversial issues, leading to recommendations for regulatory, operational, and other public policy initiatives.

The dialogue includes approximately fifty participants; five government agencies (Bureau of Land Management, Department of Defense, Fish and Wildlife Service, Forest Service, and Park Service), Congressional staff, commodity interests, environmental and preservation groups, and academia. As part of the dialogue process, each participating federal agency will document all laws, regulations and policies which provide direction on conserving biological diversity.

The forest products industry believes the national dialogue on biological diversity is a useful process under which consensus on many aspects of this issue may be forged. National dialogues such as this have proven to be successful on complex issues. For example, the National Wetlands Policy Forum Report released by the Conservation Foundation in late 1988 presents a consensus strategy for conserving America's wetlands.

V. The Courts Will Be Forced To Interpret Legislation Which Does Not Clearly Define Biological Diversity In The Context Of NEPA Compliance

The forest products industry is concerned that additional legislation passed before consensus is reached on a biological diversity definition will only add to the current complexity of regulations. An overly broad definition of biological diversity would create opportunity for unintentioned court challenges on federal actions, forcing the courts to make interpretations and decisions which should be based on scientific understanding and public consensus.

VI. The Forest Products Industry Does Not Support H.R. 1268

Many aspects of H.R. 1268 touch on important concepts that should be considered for implementation through existing programs, such as interagency coordination and additional research.

The forest products industry does not support passage of H.R. 1268 at this time for several reasons. First, the bill does not provide a precise definition of biological diversity. Using a broad definition in the context of the proposed NEPA amendments will complicate the process under which federal agencies must now proceed to implement various activities, such as timber harvest and wildlife habitat improvement projects. This will result in increased challenges to specific federal actions on grounds that an agency failed to address some aspect of biological diversity. The courts would then be forced to resolve the issue.

Secondly, the bill would require the Administrator of the Environmental Protection Agency to review and comment in writing on the adequacy of each environmental impact statement prepared under NEPA in assessing biological diversity impacts. This requirement adds an additional layer of review without any clear benefit. Also, increases in time and cost will result from this action.

We believe that a strategy on biological diversity developed through consensus is preferable to a strategy based on legislation.

VI. Conclusion

In conclusion, the forest products industry does not support passage of H.R. 1268 or other legislation on conservation of biological diversity. We do, however, support efforts to better define what additional knowledge and policy direction is needed to assure the conservation of biological diversity in a fashion that is consistent with other national priorities.

The Keystone Center national dialogue process is a positive way to reach consensus on many aspects of the biological diversity issue. We believe this process will be fruitful and will contribute to a collective view of appropriate future actions. Thank You.

Mr. **Scheuer**. Thank you very much, Mr. Ford.

Now we will hear from John Heissenbuttel.

STATEMENT OF JOHN HEISSENBUTTEL, MANAGER, RESEARCH AND POLICY, AMERICAN FOREST COUNCIL

Mr. **Heissenbuttel**. Thank you, Mr. Chairman.

Mr. **Scheuer**. Am I pronouncing your name correctly?

Mr. **Heissenbuttel**. I want to compliment you. You are the first congressional person that has ever pronounced my name correctly.

Mr. **Scheuer**. Well, I am Deutsche myself. I should be able to pronounce a good solid German name. I am a genuine product of that country.

All right. Mr. Heissenbuttel, manager of research and policy of the American Forest Council. Please proceed.

Mr. **Heissenbuttel**. Good afternoon. It is a pleasure to be here today to testify on the conservation of biological diversity and H.R. 1268. I am John Heissenbuttel, as you pronounced so correctly. And I am manager of the policy and research program for AFC.

The American Forest Council is responsible for representing the private forest management interests of the forest products industry. And as Dave Ford pointed out, we recognize that the conservation of biological diversity extends way beyond the forest ecosystem, but my comments will be directed primarily to forest management, since that is what we know most about.

Now private forest landowners have an excellent biological diversity conservation record. At the genetic level, understanding and protecting genetic integrity is a cornerstone of the forest products industry's many forest improvement and reforestation programs. The forest products industry is involved in numerous national and international cooperatives to improve our knowledge of genetic composition. Industrial forest managers understand the importance of maintaining a diverse genetic pool to assure a viable population.

At the ecosystem level, the land use that is most compatible with the conservation of biological diversity may be silvicultural management. Forest management assures a mosaic of age classes which promotes a tremendous diversity of plant and wildlife species.

The forest products industry has also worked extensively with State natural heritage programs, the Nature Conservancy and many other organizations and agencies to identify the best and most significant sites to be managed with the specific conservation of biological diversity.

We believe forest management activities in the United States are the most environmentally sound in the world. Biological diversity is a concept which is threaded throughout the laws, regulations and programs at the Federal, State and private level throughout the United States. More importantly, conservation of biological diversity is effectively practiced in forest management activities throughout the country.

Most experts, we believe, would agree that the need for conservation of biological diversity is strongest in developing nations. We recognize that domestic actions may directly affect our ability to influence actions of other countries, and this country must set an example to developing nations by demonstrating how to conserve biological diversity in a fashion which is useful to them.

We will not be effective with developing countries if we preach about the value of setting aside lands. Forest management throughout the United States demonstrates how through implementation of best management practices, temperate forests can be harvested while conserving biological diversity.

However, we have not provided useful demonstrations to developing countries showing how to manage tropical forests to both elevate developing nations' standard of living and to conserve biological diversity.

We believe any failure to conserve this Nation's biological diversity is not for lack of a law. According to the 1987 Office of Technology Assessment report entitled "Technologies to Maintain Biological Diversity," which you mentioned earlier, there are currently 28 Federal laws relating to the conservation of biological diversity.

It is important to note that the OTA list doesn't include Federal laws relating to the restoration of biological diversity such as the conservation reserve provision of the Food Security Act. Many of these laws and programs which provide the means to enhance biological diversity are not implemented to the extent possible because they are not fully funded. The American public must identify conservation of biological diversity as a national priority by first funding the programs which are in place.

Now, better coordination is necessary in order to realize the full potential of existing legislation. There are nearly 400 million acres of public land currently under Federal ecosystem conservation programs. This enormous land base is controlled by several agencies under numerous and diverse systems and philosophies, but each has the necessary legislative tools to be successful in conserving biological diversity.

Five Federal agencies along with a wide representation of the private sector, the academic community and congressional staff are currently participating in the national dialogue which has been described by many of the speakers today. This national dialogue, we believe, represents a timely, appropriate and responsible approach to enhance the conservation of biological diversity.

Now, biological diversity research is a high priority. A key to conserving biological diversity is understanding ecological relationships. The Forest Service and other Federal agencies have the necessary scientific network in place to improve this understanding.

Now, finally, the American Forest Council supports efforts to conserve biological diversity. Consequently, we are in favor and are actively participating in the national dialogue on biological diversity.

We do not support H.R. 1268, because it does not address the major issues which would substantially enhance the conservation of biological diversity. First, H.R. 1268 does not provide a solution for the inadequate funding of existing legislation. Secondly, H.R. 1268 does not focus on the real problem area: developing nations.

Now, in order to improve the conservation of biological diversity while the national dialogue is in progress, we suggest that this committee pursue the following:

First, help provide Federal agencies the resources they require to implement existing laws and programs;

Next, promote demonstrations applicable to the goals of developing nations, such as environmentally sound harvesting projects in the Caribbean national forest;

Third, increase domestic awareness through educational programs;

Fourth, initiate international dialogues to promote global conservation;

And finally, encourage research on biological diversity by supporting programs such as the U.S. Forest Service research program where they have identified that kind of research as a high priority.

I appreciate the opportunity to testify today, and I look forward to responding to any questions.

[The prepared statement of Mr. Heissenbuttel follows:]

AMERICAN FOREST COUNCIL

STATEMENT FOR THE RECORD

OF

JOHN HEISSENBUTTEL

MANAGER OF FOREST POLICY AND RESEARCH
AMERICAN FOREST COUNCIL

ON

H.R. 1268 NATIONAL BIOLOGICAL
DIVERSITY CONSERVATION AND THE
ENVIRONMENTAL RESEARCH ACT

BEFORE THE

SUBCOMMITTEE ON NATURAL RESOURCES,
AGRICULTURE RESEARCH AND ENVIRONMENT

OF THE

COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY

OF THE

UNITED STATES HOUSE OF REPRESENTATIVES

MAY 17, 1989

Good afternoon. It is a pleasure to be here today to testify on the conservation of biological diversity and H.R. 1268. My name is John Heissenbuttel. I am manager of policy and research for the American Forest Council.

The American Forest Council is jointly sponsored by the American Paper Institute and the National Forest Products Association. Together, these associations represent more than 2,500 companies throughout the United States engaged in growing and harvesting timber as well as the manufacture and distribution of forest products. The American Forest Council is responsible for representing the private forest management interests of the forest products industry.

I. Private forest landowners have an excellent biological diversity conservation record.

At the genetic level, understanding and protecting genetic integrity is a cornerstone of the forest products industry's many forest improvement and reforestation programs. The forest products industry is involved in numerous national and international cooperatives to improve on our knowledge of genetic composition. Industrial forest managers understand the importance of maintaining a diverse genetic pool to assure a viable population.

At the ecosystem level, the land use that is most compatible with the conservation of biological diversity may be silvicultural management. Forest management assures a mosaic of age classes which promotes a tremendous diversity of plant and wildlife species.

The forest products industry has worked extensively with state natural heritage programs, the Nature Conservancy, and many other organizations and agencies to identify the best and most significant sites to be managed for the conservation of biological diversity. Such sites range from the 20 acre stand of virgin Atlantic White Cedar provided recently by Robbins Lumber Company in Appleton, Maine, to the more than 60,000 acre Okefenokee Swamp in Georgia donated by Weyerhaeuser Company and Union Camp Corporation. Hundreds of other examples of private donations and cooperation by private forest landowners are found across the nation.

II. Forest management activities in the United States are the most environmentally sound in the world.

Biological diversity is a concept which is threaded throughout the laws, regulations, and programs at the federal, state, and private level in the United States. More importantly, conservation of biological diversity is effectively practiced in forest management activities throughout the country. Most experts, we believe, would agree that the need for conservation of biological diversity is strongest in developing nations.

We recognize that domestic actions may directly affect our ability to influence actions of other countries. This country must set an example to developing nations by demonstrating how to conserve biological diversity in a fashion which is useful to them. We will not be effective with developing countries if we preach about the value of setting aside lands. Forest management throughout the United States demonstrates how, through best management practices, temperate forests can be harvested while conserving biological diversity. However, we have not provided useful demonstrations to developing countries showing how to manage tropical forests to both elevate their standard of living and conserve biological diversity.

III. Any failure to conserve this nation's biological diversity is not for lack of a law.

According to the 1987 Office of Technology Assessment (OTA) report entitled, "Technologies to Maintain Biological Diversity," there are currently 28 federal laws relating to the conservation of biological diversity. It is important to note that this OTA list does not include those federal laws relating to restoration of biological diversity such as: the revegetation provision of the Surface Mining Control and Reclamation Act (Public Law 95-87); or the conservation reserve provision of the Food Security Act of 1985 (Public Law 99-198).

Many of these laws and programs which provide the means to enhance biological diversity are not implemented to the extent possible because they are not fully funded. The National Fish and Wildlife Act, known as the Nongame Act, is such an example. The American public must identify conservation of biological diversity as a national priority first by funding the programs which are in place.

IV. Better coordination is necessary in order to realize the full potential of existing legislation.

There are nearly 400 million acres of public land currently under Federal ecosystem conservation programs.

This enormous land base is controlled by several agencies under numerous and diverse systems and philosophies; each has the necessary legislated tools to be successful in conserving biological diversity. Five federal agencies (U.S. Forest Service, Bureau of Land Management, U.S. Park Service, Fish and Wildlife Service, and Department of Defense), along with a wide representation of the private sector, the academic community, and congressional staff are currently participating in a national dialogue to produce recommendations for a coordinated national effort to conserve biological diversity. This national dialogue represents a timely, appropriate, and responsible approach to enhance the conservation of biological diversity.

V. **Biological diversity research is a high priority.**

The U.S. Forest Service has appropriately identified the need to expand ongoing research and to initiate new studies leading to the understanding of ecosystem fragility and resiliency. This research is a high priority in the proposed 1990 budget. We believe that forest environment research funds should be directed primarily to long-term studies of major forest ecosystems, integrating silviculture and wildlife habitat management. A key to conserving biological diversity is understanding ecological relationships. The U.S. Forest Service and other Federal agencies have the necessary scientific network in-place to improve this understanding.

VI. **The American Forest Council supports efforts to conserve biological diversity.**

We support efforts to better define what is needed by way of additional knowledge and policy direction to assure the conservation of biological diversity in a fashion that is consistent with other national priorities. Consequently, we are in favor of and are actively participating in the national dialogue on biological diversity.

We do not support H.R. 1268 because it does not address the major issues which would substantially enhance the conservation of biological diversity. First, H.R. 1268 does not provide a solution for the inadequate funding of existing legislation; and secondly, H.R. 1268 does not focus on the real problem area -- developing nations.

In order to improve the conservation of biological diversity while the national dialogue is in progress we suggest this committee pursue the following: (1) help provide federal agencies the resources they require to implement existing laws and programs; (2) promote demonstrations applicable to the goals of developing nations such as environmentally sound harvesting projects on the Caribbean National Forest; (3) increase domestic awareness through educational programs; (4) initiate international dialogues to promote global conservation; and (5) encourage research on biological diversity by supporting programs such as U.S. Forest Service Research.

I appreciate the opportunity to testify. I will be glad to respond to any questions.

Mr. **Scheuer.** Well, I look forward to asking you questions along with the other panel members when we have heard from Mr. Waller.

But I would have to express some reservations about the thrust of your testimony. I agree with much of what you say about the importance of concentrating on biological diversity problems in the developing world. But you know, they tell us, developing-world leaders tell us, "Physician, heal thyself."

If you think that most of the problems of biological diversity fall into the developing world, I would have to disagree with you. We have a rate of destruction of the forests in Florida that exceeds that in Brazil.

I just had a hearing in January on biological diversity in the State of Hawaii. We have a horrendous problem of destruction of tropical rainforests in Hawaii.

Now another issue is the management of old-growth forests. This was mentioned by a previous witness here today. Many scientists, many, many scientists, feel that we have a problem here at home, and the fact that we will be trying to help developing countries manage their resources better, engage in sustainable harvesting of their forests and other resources means that if we are going to be credible, we have to get our own house in order.

Mr. Heissenbuttel, I beg to differ with you. Our own house is not in order. We have some egregious, severe problems of resource conservation, forest conservation in our country.

The Weyerheuser Company for many, many decades was engaged in the most unsound kind of practices in harvesting of their forests. They have recently—very recently—gotten religion, and we are delighted with that, and they are now a model of ideal, thoughtful forest husbandry based on the sustainable yield harvesting. They are now a model for the industry, but they do not represent the whole industry. There isn't any consensus out there yet. We hope that there will be a consensus emerging from this Keystone dialogue.

But nobody elected the members of that group to public office to make hard and fast public policy decisions on the 242 million people in this country.

As Members of Congress, it seems to me that we have a clear obligation to move ahead and fill the vacuum and at such time as there is a consensus this interagency coordinating committee on biodiversity will deal with that and we will, hopefully, embrace their recommendations if they are truly a consensus.

Perhaps the best way of cranking that consensus into law is by passing just the process that we have set up now because now there is no coordinating entity, not the Bureau of Wildlife and Fisheries, not the Agriculture Department, not the Department of the Interior, not the EPA.

There is no coordinating entity out there. So when they achieve their consensus, I would like to ask you, what are they going to do with it?

Mr. **Heissenbuttel.** Our belief is—if I can respond to a couple of your thoughts——

Mr. **Scheuer**. Of course, but do it briefly because I really apologize for intervening but I couldn't help it. I want to get on to Mr. Waller.

But yes, tell me what's going to happen to that consensus when it happens? Who is going to deal with it? Who is going to crank it into law or public policy?

Mr. **Heissenbuttel**. The point we are trying to make is legislation, as you propose, would force the courts into the position of defining what biological diversity is, what is needed.

Mr. **Scheuer**. Mr. Heissenbuttel, we have been over this before many, many times today, and I have asked all the witnesses who have appeared before this panel preceding you to help us avoid exactly that contingency. Surely words mean something. We can put language into this legislation that would avoid plaintiffs from having the necessity of going to the courts. That would be a most destructive process if that is generalized.

Surely we can sit down together and reason together and create language that will satisfy your industry and it will satisfy Government, will satisfy the academics and will satisfy the Congress, language that is reasonable, that is precise, that will avoid the necessity of litigating where there is general fuzziness in the legislation. We want to avoid that. We want the legislation to be specifically precise so that everybody will know where they stand and what their mission is.

Do you consider that it is beyond your ability to sit down and reason with us and try to avoid this business of your industry having to have recourse to the courts?

Mr. **Heissenbuttel**. It is the view of our industry that there are plenty of laws in place which address biological diversity which are not fully implemented because of funding.

Mr. **Scheuer**. That is true, and I think we ought to do a better job of funding this legislation and many other pieces of legislation. I voted against the budget resolution today because I thought funding levels for many programs were inadequate. I couldn't agree with you more, we ought to fund these better.

But at least this legislation provides a coordinating mechanism that doesn't exist now. This legislation, perhaps, by providing a central focus can alert both the administration and the Congress and the general public of the need to enhance funding. As it is now, there are so many different foci of concern and attention that none of them is really grabbing the public's attention and, therefore, the administration's attention and the Congress' attention.

Anyway, I appreciate your remarks, and perhaps we will have some questions for you later if we have the time.

Let's move on now to Mr. Don Waller, associate professor of botany at the University of Wisconsin, who is appearing on behalf of the Sierra Club.

STATEMENT OF DR. DONALD M. WALLER, ASSOCIATE PROFESSOR OF BOTANY, UNIVERSITY OF WISCONSIN, ON BEHALF OF SIERRA CLUB

Dr. **Waller**. Thank you very much.

I would like to mention that I am representing, I feel, both professional conservation biologists as well as the Sierra Club and a great number of other large associations. Sierra Club has over 500,000 members nationally. And Audubon and a host of other of those environmental organizations support this as well.

Mr. **Scheuer.** Excuse me, Mr. Waller, would you give us a list that we can append to your testimony of the various organizations that you represent, a specific list? May we have that?

Dr. **Waller.** Certainly.

Mr. **Scheuer.** Thank you.

[The requested information follows:]

UNIVERSITY OF WISCONSIN - Madison

Department of Botany
430 Lincoln Drive
Madison, WI 53706

May 18, 1989

Hon. James Scheuer
Chair, Subcommittee on Natural Resources, Agriculture Research and Environment
Committee on Science, Space and Technology
U.S. House of Representatives
Suite 2321 Rayburn House Office Building
Washington, D.C. 20515

Dear Representative Scheuer,

Thank you for the opportunity to present testimony yesterday before your Subcommittee. I was impressed both by the range of material presented, and especially by the deserved seriousness with which you and your Subcommittee are treating these vitally important issues.

You asked that I submit the names of the environmental organizations I was representing and documentation for statements I made regarding how Forest Service staff have responded to input from professional conservation biologists. As you know, a great many environmental and conservation organizations share a consensus on the importance of implementing more active efforts to conserve biological diversity. Those I was officially representing are:

The Sierra Club	(with over 500,000 members)
Wisconsin Audubon Council	(over 8,000 members)
Wisconsin Forest Conservation Task Force	

Background for how the Forest Service has reacted to advice on the conservation of biological diversity within the Wisconsin National Forests is contained within the "Statements of Reasons" prepared as part of the formal appeal of the Final Plans for the Nicolet and Chequamegon National Forests by the Sierra Club and Wisconsin Forest Conservation Task Force. I enclose the Table of Contents and Summary of the Statement of Reasons on the Chequamegon appeal, along with selected supporting material, to represent these much longer documents. Please contact me if you would like a copy of either the complete document or other sections. In the time since this appeal was first filed (November 1986), the Wisconsin Forest Conservation Task Force has provided many further scientific documents and other materials supporting the positions taken in the Statements of Reason. The Forest Service, however, continues to reject the implications of this research for forest management. As you know from your hearings, they and the timber industry have steadfastly maintained that definitions remain imprecise, knowledge is still incomplete, and that current forestry practices serve admirably to maintain and enhance biological diversity. This appeal has yet to be decided by the Chief of the U.S. Forest Service.

Finally, I would like to reiterate one comment I made that was not a part of my written testimony. A single, simple and inexpensive measure that could be taken to improve the functioning of the many federal agencies entrusted with protecting biological diversity would be to establish a procedure to periodically review the policies and practices of each agency for their efficacy in protecting diversity. The reviews should be conducted by "outside" committees with members chosen by the National Academy of Sciences or some other group of independent scientists with expertise and credibility. Such reviews are routine within Universities for academic programs and serve well to ensure high standards and consistency. Although this is a very simple step, I predict that it would do wonders to improve the performance of the agencies with regard to conserving diversity. As Dr. Lovejoy emphasized, it is also essential that the Center for Biological Diversity and Conservation Research and its Governing Board have complete scientific integrity. I, personally, would welcome the Smithsonian Institution as a home for this Center as I feel that it has the best expertise in this area as well as great respect throughout the scientific community.

Thank you for the opportunity to contribute these comments, and do not hesitate to contact me if you or your staff desire further materials.

Sincerely,

Donald M. Waller

Donald M. Waller
Associate Professor
(608) 263-2042 / 262-1058

Dr. **Waller.** I would also like to applaud your concern and leadership on this issue of biological diversity. You are facing up to a national responsibility, and you are providing a mechanism that is flexible, like our Federal Constitution, that allows this Center and these committees to evolve with changes in understanding, changes in agency mission and personnel and so on. It is a very flexible system that you envision.

In fact, it is very difficult for me to understand how anybody in favor of biological diversity could be against your bill. I think it is already carefully crafted. But that won't keep me from making a few suggestions for improvement at the end.

There is a remarkable consensus that exists now not just among scientists but among the public at large, I would argue, that biological diversity is a vital central interest for our society, and there is also consensus that we now have the knowledge—it will never be complete—but have the knowledge and capability and interest of the scientific community to effectively implement strategies to conserve diversity.

We need cost-benefit analyses, we need priorities to be set, we need Keystone conferences and input from all available corners. But that is no excuse for inaction on a matter that is this pressing.

Biological diversity, besides being such an important issue, is also one of our most challenging issues. It is an irreplaceable resource. It remains one of our least studied resources. And we still lack thorough and systematic inventories of even common species on our national lands.

Thus we find that one of the most vital links in our chain of environmental protection surprisingly remains the weakest.

Let me skip over and mention that it is my opinion that current Federal agencies and legislation like the Endangered Species Act, while doing a credible job in particular quarters, are not doing nearly the scale and scope of job that needs to be done. We are faced with big problems, we need big solutions.

In particular, the Endangered Species Act, so essential for protecting the very vulnerable species that have been well studied, leaves substantially unprotected that vast group of understudied species which remain unknown, too unknown to even be listed. There are some 20,000 species of plants just in the continental U.S. and at least three times that number of invertebrate species.

We need to protect diversity wholesale, not retail. We need to be efficient in our use of resources. We need to take systematic and strategic approaches to this conservation of diversity. And your bill, it seems, is targeted directly in that area.

The Federal agencies are also plagued by a variety of conflicting demands that have sometimes prevented them from effectively protecting biological diversity. We have heard testimony today from the Forest Service as well as other agencies. And my own personal experience is primarily with the Forest Service. We have been told that they are conducting workshops, that they are engaged in this Keystone process and so on.

And I would just like to enter officially that in my experience the Forest Service has been very good at soliciting input, and not very good at all in following it. In fact, they have systematically ignored scientific input on a number of occasions.

Mr. **Scheuer**. Can you document that statement, Mr. Waller?

Dr. **Waller**. Certainly I can. I try to make no statements that I can't document.

In the case of the Chequamegon and Nicollet national forests in northern Wisconsin we—that is, a group of biologists at the University of Wisconsin—became concerned that this long-range plan that the Forest Service has so touted as the first line of defense for biological diversity was seriously inadequate with regard to their plans for protecting diversity. We drew up a number of recommendations at both the draft and final plan stages and attempted to encourage them to move in a direction that we felt would more protect diversity. In particular, we documented losses, imminent losses, of plant species diversity in these forests due to extremely high densities of white-tailed deer in northern Wisconsin which were being furthered by the Forest Service's practice of widespread clearcuts.

We also solicited input from 12 or 13 of the top conservation biologists in this country, the E.O. Wilsons, the Peter Ravens, the Bob Mays and Terborgs and so on that are leaders in this field. All of them were supportive of our recommendations to the Forest Service. And yet all these recommendations, or most of them, I should say, were systematically ignored, especially the central ones concerning the need to at least allocate a few large blocks of land that would be allowed to mature for a period long enough to at least study the issue and come up with some systematic approach to the biodiversity issue.

I also have documentation that concerns with analyzing viable populations and choosing indicator species directly ignored scientific input on how that should best be done.

Mr. **Scheuer**. If you think of any further documentation for that assertion of yours, please give it to us, and we will either include it in your direct testimony or we will add it.

Dr. **Waller**. Do you realize what you are asking for?

Mr. **Scheuer**. Pardon?

Dr. **Waller**. Do you realize what you are asking for?

Mr. **Scheuer**. Well, I think it's important to make that evidence a part of this record.

Dr. **Waller**. I would agree.

We have prepared an 800-page set of documents, the statements of reasons in support of our appeals on the Chequamegon and Nicollet national forests.

Mr. **Scheuer**. Well, maybe we could slim that down a little. [Laughter.]

Dr. **Waller**. Okay.

[The information follows:]

9.

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May 23, 1989

VIA FEDERAL EXPRESS

The Honorable James Scheuer
U. S. House of Representatives
Suite 2321
Rayburn House Office Building
Washington, D.C. 20515

Re: Chequamegon National Forest Plan Appeal; Biological Diversity

Dear Representative Scheuer:

To follow up on his testimony before your committee, Dr. Donald Waller asked me to forward to you the enclosed materials regarding the conservationists' appeal to the Chequamegon National Forest Land and Resource Management Plan. Enclosed are the Statement of Reasons, Appendix to Statement of Reasons, Reply (and Appendix to Reply) and Appellants' Written Submission Following Oral Argument.

As you know, this Chequamegon appeal solely addresses the failure of the Forest Service to address the effects of proposed management practices on the structure and function of plant and animal communities in the Forest.

This appeal was filed in the fall of 1986, and we still await a decision from the Chief's office. Except for a few brief meetings to discuss current projects in the Forest, the Forest Service has failed to engage in any serious discussion with these appellants as to the manner in which the scientific information contained in these appeal documents could be incorporated into either the management of the two Wisconsin forests, or Forest Service practices more generally.

Please note the letters of support for this appeal, found in the Appendix, pages 10 through 34, from prominent scientists of national reputation, including Paul Ehrlich, Jared Diamond, Daniel Janzen, Peter Raven, Michael Soule, Edward O. Wilson and others.

These same issues have been raised in the appeal of the Plan for the other Wisconsin National Forest, the Nicolet. Despite the substantial filings of these appellants, and continual appeals of individual timber sales on the Nicolet over a period of two and one half (2 1/2) years, the Nicolet continues to use a definition of "old growth" that expressly calls for increased fragmentation of habitats! As Dr. Waller has said in comments regarding the Forest Service "old growth" policy still in use in a January 1989 timber sale decision for the Nicolet, "... it would be difficult to design a set of criteria less suitable for protecting the biotic integrity of old growth areas or enhancing progress toward their restoration."

In short, the Forest Service is completely unwilling to seriously incorporate into its management practices the mandate in the National Forest Management Act to "... provide for diversity of plant and animal communities...." Determining the biological consequences of timber management practices should not be left to timber managers; the scientific community must be given a vehicle to introduce objective biological information into public land management decisions.

Finally, it should be noted that although these additional organizations do not appear in the captions of the enclosures, the Wisconsin Audubon Council and The Wilderness Society filed parallel appeals in both Wisconsin National Forest Plans, and simply incorporated by reference in their entirety the filings made by the parties named in these captions.

Please advise if you or your staff would like any further information on these appeals.

Very truly yours,

BOARDMAN, SUHR, CURRY & FIELD
By

Walter Kuhlmann

WK/cab
Enclosure
cc: Dr.Donald M. Waller
George Hall (Sierra Club -- John Muir (Wisconsin) Chapter)
Carl Zichella (Sierra Club -- Midwest Office)
Sharon Clark Gaskill (Audubon Society)

D. Waller

UNITED STATES DEPARTMENT OF AGRICULTURE
BEFORE THE CHIEF, U.S.D.A. FOREST SERVICE

In Re Appeal of the Record of Decision, Dated August 11, 1986, Approving the Land and Resource Management Plan and Final Environmental Impact Statement for the CHEQUAMEGON NATIONAL FOREST

SIERRA CLUB, JOHN MUIR CHAPTER, and WISCONSIN FOREST CONSERVATION TASK FORCE,

Appellants.

STATEMENT OF REASONS

Appeal No. 1732

Walter Kuhlmann
Attorney for Appellants Sierra Club, John Muir Chapter, and Wisconsin Forest Conservation Task Force

OF COUNSEL:

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TABLE OF CONTENTS

Page

INTRODUCTION 1

I. SUMMARY OF POSITION 1

II. HISTORY OF CHEQUAMEGON NATIONAL FOREST 6

III. CRITICISMS OF THE PLAN AND FEIS 11

- A. Failures to Properly Define and Consider Diversity 12
  - 1. Concepts of Diversity 12
  - 2. Usage of the Term "Diversity" by the Forest Service 16
- B. Failure to Adequately Consider Natural Population Dynamics in a Fragmented Landscape 18
- C. Failure to Recognize the Role of Natural Patch and Successional Dynamics 23
  - 1. Natural Disturbance Regime 23
  - 2. Effects of Selective Cutting on Succession and Diversity 27
- D. Failure to Understand or Account for the Difficulties of Maintaining Diversity With the Accelerated Turnover and Local Extinction Accompanying Fragmentation 29
  - 1. Basic Concepts 29
  - 2. Problems Inherent in the Plan 35
- E. The Failure to Apply Principles of Island Biogeography 37
  - 1. Concepts 37
  - 2. The Failure to Consider the Theory of Island Biogeography and Its Application to Forest Service Planning 41
- F. Failure to Consider the Consequences of Edge Effects on Biotic Diversity 49
- G. Failure to Provide Adequate Means of Evaluating and Monitoring Biotic Diversity .. 69
  - 1. Legal Requirements to Survey Biological Diversity and Maintain Viable Populations 70
  - 2. Role of Management Indicator Species ... 72

Page

3. Choice of Management Indicator Species . 73
4. Estimating Minimum Viable Population Sizes 79
5. Monitoring Population Sizes of MISs 87

H. Why the Planning and Analysis Procedures of the Forest Service Fail to Adequately Consider Issues of Biotic Diversity 90

IV. APPELLANTS' POSITION IS SUPPORTED BY THE WEIGHT OF PROFESSIONAL OPINION 94

V. THE LEGAL REQUIREMENTS OF THE NATIONAL FOREST MANAGEMENT ACT AND REGULATIONS MANDATE ESTABLISHMENT OF THESE DIVERSITY ENHANCEMENT AREAS 96

A. The Plan and FEIS are Legally Insufficient Due to the Numerous Failings to Adequately Address Diversity 97
1. The Basis Statutory Mandate for Diversity 97
2. Why the Failures of the Plan Described in Part III Make the Plan Legally Insufficient to Meet the Mandate for Diversity 100

B. The Plan and FEIS are Unlawful in That They Will Lead to a Reduction in Diversity Contrary to the Mandate of the NFMA and Regulations 104

C. The Forest Service Has Conceded That Other Multiple-Use Objectives of the Plan Can be Satisfied Even if the DMAs are Established, Thus Relinquishing Any Legal Basis for Tolerating a Reduction in Diversity 105
1. Analysis of Multiple-Use Objectives by the Chequamegon National Forest Staff .. 105
2. Submissions by the Chequamegon National Forest Staff to the Regional Office, and Regional Office Comments ... 111
3. Lack of Any Contrary Analysis by the Regional Forester's Office 115
4. Conclusion 118

D. The Regional Office Cannot Legally Draft the Plan, But Rather Must Disapprove a Plan With Which it Does Not Agree 119

Page

E. In Addition to Violating the Diversity Mandate, the Plan and FEIS are Violative of the "Fish and Wildlife Resource" Regulation Under the NFMA 121

F. In Addition to Violating the Diversity Mandate, the Plan and FEIS are Violate of the Multiple-Use Sustained-Yield Act of 1960 and the Provisions of the National Forest Management Act Which Incorporate the Multiple Use Concept 122

VI. RELIEF REQUESTED 126

A. Establishment of Diversity Maintenance Areas 126
1. History of the Diversity Maintenance Areas (DMAs) 127
2. Location of the Diversity Maintenance Areas 127
3. Size and Shape of the Diversity Maintenance Areas 128
4. Management of Diversity Maintenance Areas 129

B. Other Steps to Ensure the Maintenance of Diversity 129
1. The Need for a Comprehensive Biological Inventory 130
2. True Indicator Species Need to be Selected That Will be Sensitive to Forest Management Practices 132
3. Population Monitoring and Analysis 132

C. Implementing a Responsible Research Program . 134
1. Estimating Viable Population Sizes 135
2. Research on Edge Effects and Community Processes 136
3. Diversity Maintenance Area Research Committee 137

VII. CONCLUSION 139

INTRODUCTION

This document and Appendices together constitute the Statement of Reasons filed on behalf of appellants Sierra Club (John Muir Chapter) and Wisconsin Forest Conservation Task Force in support of their appeal from the Record of Decision dated August 11, 1986 approving the Final Plan and Environmental Impact Statement for the Chequamegon National Forest.

The Sierra Club, John Muir Chapter, is a conservation organization with approximately 5,730 members in Wisconsin. The Task Force is a group of concerned individuals formed specifically for the purpose of analyzing the management plans for the two National Forests in Wisconsin.

The principal drafters of the biological exposition contained in this Statement are William Alverson, Stephen Solheim and Donald Waller of the Department of Botany, University of Wisconsin, Madison, Wisconsin. Other contributors to this Statement include George Hall, Public Lands Chairman of the John Muir Chapter and member of the Task Force, and Tom Gibson. Other members of the Task Force include E. Judziewicz, E. King, L. Gruel, K. Kearns, H. Metzenberg, M. Simpson and L. Travis.

I. SUMMARY OF POSITION

On August 11, 1986, the Regional Forester signed the Record of Decision approving the Final Plan (hereafter "the Plan") and

Final Environmental Impact Statement (hereafter "FEIS" or "Final EIS") for the Chequamegon National Forest. This Plan, which will govern the Forest for the next 10 to 15 years, and will serve as the groundwork for planning for at least the next 50 years proposes that the Forest be divided into many parcels, each of which will be managed according to a specific "management prescription." Most of the Forest (60%) is allocated for the eventual production of timber and pulpwood by clearcutting (36% aspen, 14% mixed hardwoods and 10% conifers). The bulk of the rest of the Forest is to be managed for timber production via selective cutting (30% sugar maple and 6% "long-rotation" mixed hardwoods). The remaining 4% is to be managed as wilderness (1%) and under a variety of special uses for game, recreation and research. The Plan and FEIS declare that this allocation of lands will provide the most desired mix of multiple uses of the Forest while maintaining biological diversity and recreational values. These documents also equate biological diversity with varied habitat and particularly age-class variety, thereby justifying extensive logging and the creation of additional "openings" for white-tailed deer and other game wildlife.

Appellants' main concern is that the Plan and FEIS emphasize commodity production without making adequate provision to "preserve and enhance the diversity of plant and animal communities" as required by the National Forest Management Act and underlying regulations. In particular, implementing the Plan will tend to fragment and homogenize the Forest while limiting opportunities for species that require forest interior conditions. The Plan fails to show how formerly common tree species (hardwoods, hemlock and white cedar) that reproduce poorly now (in part because of high deer density) will be regenerated. In addition, increased fragmentation of the Forest by roads and patch cutting allow the rapid invasion of weedy plants and animals that compete with and displace the original forest species. This fragmentation will also reduce and isolate local populations of forest interior songbirds, top carnivores, and other vertebrates, making them vulnerable to inbreeding and chance extirpation. For example, songbirds suffer directly via increased predation and parasitism in forest patches. By not ensuring minimum viable populations of these species, the Plan threatens to reduce the Chequamegon's overall diversity.

Because the Plan fails to account for these phenomena, and hence fails to grasp the key elements that dictate the current and expected trends in diversity on the Forest, the Plan does not begin to come to terms with the current vector of decreasing diversity, and develops no program for halting or reversing these effects. Therefore, the Plan fails to meet the legal mandates that diversity be inventoried and then preserved and enhanced, and the Plan cannot be sustained by the Chief of the Forest Service. A Plan which does not identify or understand the basic biological mechanisms at work in its forest, but rather establishes a program which, to a reasonable degree of scientific certainty, accelerates the extirpation of species and the reduction of diversity, cannot be upheld by the Forest Service.

To ensure the long-term maintenance of species diversity in the Forest, we request that the Plan be revised to provide two large contiguous areas of eventually old-growth forest and institute a set of management prescriptions that will protect these areas from disturbances such as logging and road-building, so their relatively undisturbed character can be maintained. Also, a research program should be established that would investigate population and community dynamics in these and smaller blocks. These "Diversity Maintenance Areas" (DMAs) will complement the small (5-50 acre), special-purpose management prescriptions designated for protecting particularly valuable areas and the medium sized (5,000 acre) wilderness areas. Management of these areas will involve minimal interference and cost, but will allow sensitive species to survive and increase in population. The total area of the two specific DMAs recommended by these appellants, and adopted by the Chequamegon Forest Supervisor's Office, (140,000 acres) represents about 17% of the total Forest, yet their protection will involve no reduction in the economic productivity of the Forest during the planning period since cutting can readily be moved to other areas in the Forest.

Although the Chequamegon staff did not take proper account of the biological mechanisms at work in their Forest, they were willing to establish the suggested areas of 140,000 acres, and indeed included these areas quite specifically in the draft Plan sent to the Regional Office in late May to early June of 1986. This was the Forest Supervisor's desired Plan. However, at an apparently brief meeting of June 17, 1986, the decision was made by the Regional Office that the Forest Supervisor's plan would be changed to suit the desires of the Regional Office. We will demonstrate that this about-face was not based on any scientific or management analysis as had been the work of the Forest Supervisor's Office. Further, the work of the Chequamegon staff and the language of the Record of Decision itself demonstrates that the scientifically sound program for maintaining diversity by establishing these two areas would not have caused any reduction in other multiple-use objectives during the planning period. Thus no justification exists for permitting the reduction in diversity that can be expected to result if these areas are not established.

The Forest Service must understand the biological significance of the resources it controls. The importance of these resources, the value of extinction-prone species, and the biological mechanisms at work in these forest are not reflected at all in the cumbersome FORPLAN model to which the Forest Service seems enslaved in generating its management directions. This appeal asks the planners to turn off the computer, study the biology of the Chequamegon, and protect 17% of this Forest from the current trends toward extirpation and extinction. Since that 17% can be protected at no price in timber outputs, no rational decision maker should deny this appeal.

D. Waller

UNITED STATES DEPARTMENT OF AGRICULTURE
BEFORE THE CHIEF, U.S.D.A. FOREST SERVICE

In Re Appeal of the Record of Decision, Dated August 11, 1986, Approving the Land and Resource Management Plan and Final Environmental Impact Statement for the CHEQUAMEGON NATIONAL FOREST	)	APPENDIX TO STATEMENT OF REASONS
SIERRA CLUB, JOHN MUIR CHAPTER, and WISCONSIN FOREST CONSERVATION TASK FORCE, Appellants.	)	Appeal No. 1732

Walter Kuhlmann
Attorney for Appellants Sierra Club, John Muir Chapter, and Wisconsin Forest Conservation Task Force

OF COUNSEL:

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Index to Appendix

Document Page

1. Diversity References

List of References Cited 1

2. Statements by Experts on Biotic Diversity

Letter of Jared M. Diamond 10
Letter of Paul R. Ehrlich 12
Letter of Barry R. Flamm 13
Letter of Richard T.T. Forman 15
Letter of Larry D. Harris 18
Letter of Daniel H. Janzen............................ 21
Letter of Robert M. May 23
Letter of Peter H. Raven 24
Letter of Daniel Simberloff 26
Letter of Michael E. Soulè 29
Letter of David S. Wilcove 30
Letter of Bruce A. Wilcox 32
Letter of Edward O. Wilson 34

3. Brief Bibliographies of Experts on Biotic Diversity

Brief Bibliographies of Experts on Biotic Diversity.... 35

4. Documents Reflecting Treatment of Diversity in Planning Process

Excerpt (Chapters 5 and 6), from Conservationists'
Response to the Chequamegon National Forest Plan....... 41

Letter from Steve Solheim and Bil Alverson to John Vrablec, 1/20/86.................................... 46

Memorandum from David Kapaldo, 2/10/86 Re: Documentation for incorporating the Island Biogeography (IBG) concept into the final planning documents............. 49

Forest Planning Documentation Records, Author: D. Kapaldo, Feb. - June, 1986, Re: Assessing the Impacts of the Biotic Diversity Study Areas.................. 60

Memorandum Re: Timber Producers Association Meeting, 3/7/86... 77

Memorandum Re: Wisconsin Paper Council meeting, 3/10/86.. 86

Memorandum from John Vrablec to Regional Forester, 3/31/86.. 91

Letter from John H. Ohman to Regional Forester, 4/18/86.. 93

Message Scan, 4/21/86................................ 94

Letter from John C. Wolter to Mark R. Stelle, 4/23/86.. 96

Letter from John Vrablec to Robert Hann, 4/25/86....... 99

Letter from Robert Hann to Supervisor, Chequamegon NF, 4/30/86.. 117

Draft of ROD, Chapter IV of draft of Plan (mid-May to mid-June, 1986)...................................... 118

Tech Team Comments on Chequamegon NF ROD, covered by Lintelmann memorandum, 6/20/86........................ 140

Message Scan, 6/18/86................................ 145

Message Scan, 6/19/86................................ 148

Message Scan, 6/19/86................................ 150

Permanent Exclosure Record, Foulds Creek (excerpt)..... 152

A Comparative Analysis of Vegetation Within and Outside a Deer Exclosure Area, May 27, 1970, by Jim Gabrielsen (excerpt)... 154

Environmental Assessment for Spider Lake Deer Yard (excerpt)........ 156

Bear Lake Deer Yard Plan, November 17, 1982 (excerpt).. 161

Pelican Lake Deer Yard Plan, December 4, 1981 (excerpt)........ 164

Moose Hill Deer Yard Management Plan, June 6, 1986 (excerpt)........ 167

Candidate Sensitive Species List, H. Sheldon, November 6, 1985 (excerpt)........ 170

Selecting Management Indicator Species, H. Sheldon, July 31, 1984 (excerpt)........ 175

Procedure for Determining and Maintaining Viable Populations of Wildlife Species on the Chequamegon National Forest, H. Sheldon, August 23, 1984 (excerpt)........ 180

1985 Deer Population Estimates, February 7, 1986....... 188

Memorandum of L. Henson to Forest Supervisors, 11/18/83........ 191

Affidavit of W. Kuhlmann........ 192

5. List of Common and Scientific Names

List of Common and Scientific Names........ 203

ISSUE: HOW SHOULD THE IBG (BIO-DIVERSITY) ISSUE ON THE CHEQUAMEGON AND NICOLET BE ADDRESSED IN THEIR FINAL FOREST PLANS?

ALTERNATIVES:

1. Do not make a decision on IBGs in the Final Plan. Do not discuss except as a public issue.

②. Make a decision to set aside IBG areas for study in the Finals. Include the 140,000 acre tract on the Cheq. plus the opportunity for study on Research Natural and Wilderness Areas on both Forests. Request, under "Research Needs" in the Plans for both Forests, that NF Research conduct studies on this concept.

3. Make a decision in the Finals to delay activities in selected areas, if necessary, to allow for study by outside groups. Do not advocate NF research.

4. Delay a decision and provide time for more public involvement.(This delay would have to apply to both Forests.) Then issue a-supplemental FEIS with a decision.

5. Do not make a decision in the Final Plans. State that the decision to delay or adjust activities or to allow study of the IBG concept is the Forest Supervisors to make during Forest Plan implementation. (preferred)

LACKS COMMITMENT

RATIONALE FOR THE PREFERRED ALTERNAIIVE

A. There is no decision on IBGs therefore the Plans cannot be appealed on this issue. The Plans can then become final without being encumbered by further controversy.

B. The decision is placed on the Forest Supervisors during implementation. This has several advantages.

(1) Can allow for more public discussion without encumbering the Plans.

(2) Allows both Forest Supervisors to be responsive within their own management situation.

(3.) Appeal of a decision by the Forest Supervisor to delay activities to allow for studies can not be based on failure to meet NFMA or NEPA requirements.

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United States
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R-9

Reply to: 1920 Land and Resource Management Planning
2620 Planning

Date: NOV 18 1983

Subject: Viable Populations of Vertebrate Species

To: Forest Supervisors

Attached is a draft paper "Viable Population Analysis -- A question of Risk" developed by the National Wildlife and Fisheries Ecology Unit. This material provides a methodology for the Forest that has not addressed the planning requirements for viable populations (36 CFR 219.19). The central message is that a determination of viable populations is an analysis of risk, and not an absolute assurance of population stability. This procedure represents an opportunity to streamline compliance with the planning requirement and to reduce the impact some Forests have faced in addressing viable populations.

The paper, together with the attached forms, provides a process for identifying species where viability may or may not be a problem, determining habitat needs to support viable populations and arriving at an estimate of the certainty of continued existence for the identified species. Also enclosed, are copies of the transparencies used by Hal Salwasser at the recent National Planners meeting, and the R-9 Wildlife Workshop.

Larry Henson
LARRY HENSON
Regional Forester

Enclosure

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Radtke, RRWL

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UNIVERSITY OF CALIFORNIA, LOS ANGELES
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DEPARTMENT OF PHYSIOLOGY
UCLA SCHOOL OF MEDICINE
CENTER FOR THE HEALTH SCIENCES
LOS ANGELES, CALIFORNIA 90024

August 11, 1986

Mr. Bill Alverson and Stephen Solheim
Dr. Hugh Iltis and Donald Waller
Department of Botany
132 Birge Hall, 430 Lincoln Drive
University of Wisconsin
Madison, Wisconsin 53706

Gentlemen:

In your letter of July 28 you asked me to comment on the wisdom of setting aside large areas of ca. 20,000 hectares in the Chequamegon and Nicolet National Forests. The underlying issue is a familiar, much-debated one in management of natural resources: does it suffice to preserve numerous small areas, or are there unique biological needs that can only be met by a few large areas?

Many studies on a wide variety of natural systems have made it clear that there are indeed unique values to large reserves. Especially, there are certain types of species that are capable of surviving only in large tracts: notably, species with large territories or population densities, that could not maintain a stable population in small tracts; and sedentary species of low dispersal ability, for which the frequent extinctions inevitable in small tracts cannot be readily reversed by recolonzation. It usually turns out that these species requiring large tracts tend to be the species of most concern to conservationists and most likely to have rippling effects on the rest of the ecosystem, such as large-bodied species and carnivores. Such species are doomed to disappear in a system consisting of ten small tracts, each one-tenth the area of a large tract that would be adequate to maintain them.

A further feature of large tracts that has been appreciated only recently is the significance of edge effects. The edge of a habitat tract differs considerably from the interior because of exposure to edge physical forces (temperature, wind, sun, etc.) as well as to the "rain of colonists" from adjacent habitats. Small tracts tend to lose species characteristics of the interior of such a habitat and to fill up with species of alien habitats. Thus, small pieces of habitat tend not to preserve the ecosystems supposedly characteristic of the habitat.

There are of course certain special purposes well served by small tracts, such as conservation of very local insect or plant populations living at high population densities, or protection against total destruction of a habitat by fire or a pest. However, it turns out that, in most management situations involving forests, the correct solution is to have one or a few large blocks in addition to various small blocks. I have done much consulting in recent years for the national park and national forest systems of countries as diverse as New Zealand, Indonesia, and African countries, and they are all in agreement on emphasizing large tracts of forest. I enclose a couple of reprints on these questions.

Thus, your preference for setting aside larger areas in the Chequamegon and Nicolet National Forests is biologically sound.

Sincerely yours,

Jared M. Diamond
Professor of Physiology

JMD:lao
encl.

STANFORD UNIVERSITY, STANFORD, CALIFORNIA 94305

PAUL R. EHRLICH
BING PROFESSOR OF POPULATION STUDIES
DEPARTMENT OF BIOLOGICAL SCIENCES

November 19, 1986

B. Alverson, S. Solheim and D. Waller
Botany Department
University of Wisconsin
430 Lincoln Drive
Madison, WI 53706

Gentlemen:

I am writing in response to your request for comments on your proposal to create "Diversity Management Areas" in the National Forests of Wisconsin. I have examined your documents critically and fully agree with the conclusion that to protect the biological diversity of the Forests areas of ca. 100,000 acres should be protected.

The many studies of "island" populations (including habitat islands resulting from forest fragmentation.) have made it clear that preserves on the traditional scale of 20-1000 acres will not suffice for long-term maintenance of many species. No one can say with any certainty exactly how large reserves must be, but surely 100,000 acres is a not an overestimate. In fact, when edge effects such as nest predation and parasitism affecting songbirds or the major effects of herbivory by inflated deer populations are considered, 100,000 acres may well be too conservative an estimate. It is also these very edge effects which emphasize that old-growth forest stands are truly islands even though surrounded by younger forests. That is, as Janzen has recently discussed as the "eternal external threat", climax patches surrounded by secondary forest may be in some ways worse off than if surrounded by a completely dissimilar vegetation type because of interference by predators, herbivores and the rain of propagules of disturbance species into the older-growth forest.

Thus I wholeheartedly endorse your proposal and further urge that the Forest Service adopt this sort of consideration of island biogeographic principles, realistic criteria for minimum viable populations and attention to edge effects in planning for biological diversity on National Forest lands.

Sincerely,

Paul R. Ehrlich

Bil cc

THE WILDERNESS SOCIETY

September 18, 1986

Mr. Hugh H. Iltis
Mr. Bil Alverson
Mr. Stephen Solheim
Mr. Donald M. Waller
University of Wisconsin-Madison
Department of Botany
132 Birge Hall
430 Lincoln Drive
Madison, Wisconsin 53706

Dear Hugh, Bil, Stephen, and Donald,

I apologize for the delay in replying to your July 28, 1986 letter. I spent August in the field in the Rocky Mountains and early September in Washington state.

I am pleased to address your concerns regarding the establishment of biological reserves in northern Wisconsin. As way of background, I have extensive experience in natural resource and policy formulation nationally and internationally. I spent 26 years with the federal government in conservation work at all levels of the Forest Service, with the Agency for International Development, as senior staff for the President's Council on Environmental Quality and as Director of the Office of Environmental Quality, USDA. Since leaving the federal government in 1981, I have consulted on environmental matters and studied tropical forest ecology. I have degrees in Forestry and Public Administration, and presently I am a Ph.D. candidate in Plant Ecology. I have been Chief Forester for The Wilderness Society for the past 1 1/2 years.

I personally consider the loss of biological diversity the most important environmental problem facing this planet. Unless we dramatically alter our current practices, the earth will lose a large share of its species during our lifetime. Biological diversity is also being seriously affected by the loss of genetic diversity within species and the destruction of whole ecosystems.

Iltis, Alverson, Solheim, Waller
September 18, 1986
Page two

We have a major opportunity to protect this nation's biological diversity through our public lands, especially national forests. The forests provide the chance to save diversity through the protection of complete ecosystems, which is more effective and efficient than the gene bank or individual species approach. Wisconsin is fortunate to have the Chequamegon and Nicolet National Forests. These forests should be managed as a reservoir for biological diversity.

Growing scientific evidence points to the need to protect large blocks of relatively undisturbed forest in order to conserve both biological diversity and ecological processes. Because of past land use practices in Wisconsin, accomplishment of the goal of protecting large blocks requires creative forest planning and changes in forest practices.

I am impressed by your efforts on the Nicolet and Chequamegon National Forests and endorse the setting aside of 20 to 25 percent of the land in large blocks on these forests. I also agree with the criteria used in designating the "Island Biogeographic Management Areas" on the Chequamegon National Forest.

I hope these brief comments are of assistance.

Sincerely,

Barry R. Flamm
Chief Forester

BRF/jwr

HARVARD UNIVERSITY GRADUATE SCHOOL OF DESIGN

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Dr. Donald M. Waller
Department of Botany
University of Wisconsin
Madison, Wisconsin 53706

September 12, 1986

Dear Dr. Waller:

Thank you for your letter concerning planning progress for long-term management of the Nicolet National Forest, and outlining some of the scientific evidence needed to underpin such a plan. You may or may not know that almost 25 years ago I taught at the University of Wisconsin for three years, and continue to hold a special feeling of warmth for the Nicolet National Forest. It is a highly significant resource, not only to the people of Wisconsin, but indeed in the Midwest and nation as a whole.

I am impressed and agrec with the general thrust and major scientific arguments you and your colleagues have described. Permit me to suggest that the plan could be additionally strengthened to accomplish both the National Forest planners' and your objectives by developing it more solidly or explicitly on landscape ecological principles.* This of course provides a spatial framework for integrating ecosystem science, island biogeography theory, and principles of physics, forestry, wildlife managment, and geography. It offers a powerful basis for planning the spatial compatibility of growing productive wood products, maintaining game populations, providing for interior species, etc.

Let me briefly introduce a few points to complement your description.

1. The Nicolet National Forest is a heterogeneous landscape characterized structurally by a spatial configuration of ecosystems, functionally by the flows of water, nutrients, energy, plants, and animals among the ecosystems, and through time by a changing mosaic controlled by natural and human disturbances and regrowth. Therefore, the key features of any plan include: (a) patch shapes, sizes, and configurations; (b) corridor widths and breaks; (c) interactions between adjacent ecosystems; and (d) the roles of other spatial parameters such as interdigitation, orientation relative to primary forces, mesh size, and network connectivity and circuitry.

2.

2. The Forest landscape has no uncrossable boundaries and is closely tied to the rest of the region. People, animals, water, nutrients, and pollutants all enter and leave the Forest. Similarly, management for particular species in the Forest must be viewed in the regional perspective. Species relatively common or well represented outside the Forest should not be purposely enhanced within this landscape, since their success is reasonably secure for the time being outside of the Forest. Rather, forest interior species, especially the National Forest's wildlife species which are uncommon in the region, are those that should be a primary focus of management in the Forest. Indeed, increasing many of the "outside" species within the Forest will inhibit these forest interior species, especially the regionally scarce wildlife species.

3. A habitat fragmentation process decreases the "grain size" of the landscape. A fine grained landscape will contain predominantly edge species and those species that use more than one ecosystem. A coarse grained landscape, on the other hand, enhances forest interior species (and still permits the edge species and species using more than one ecosystem to remain). Our studies of fine grained cutting patterns in the conifer forests of the Pacific Northwest have indicated problems of major proportions for old growth habitat, windthrow susceptibility, and interior species.

4. Spatial separation of relatively incompatible uses is especially important in the plan. Thus for example, large remote tracts to enhance interior species can be surrounded by large tracts around the edge of the landscape where logging and associated road building is concentrated. The large edge tracts furthermore are well suited for concentrations of edge and open country wildlife, providing good hunting land and also a source of game for broad areas surrounding the National Forest. As in some forests in France, visitors also tend to see more animals when wildlife habitat is concentrated near the beginnings of trails.

5. Large remote tracts with low levels of human activity (e.g., low road and trail density) are required to maintain and enhance some of our most important rare or endangered mammal and bird species. Such tracts in the region basically are only provided in the National Forest and are of highest priority. These and many other species evolved in and are adapted to natural disturbance regimes, such as windthrows and beaver or insect related activities. The large remote tracts are thus also critical to maintain the range of patch shapes and sizes of natural disturbance regimes, which are not mimicked adequately by human disturance regimes. Finally, large remote tracts are clearly the best mechanism for protecting the headwaters of river and stream systems. In this way a large number of critical first, second and third order streams are protected, and are

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linked together in a network which provides stability to fish and other aquatic or wetland populations.

In conclusion, the Nicolet National Forest is clearly a key resource in the Midwest, and a focus on its most unique values and characteristics will pay rich dividends for the future. The emerging principles of landscape ecology can be profitably applied to management here. Wise management leads to ecologically sound economic production in spatial compatibility with the natural areas present.

With best wishes.

Sincerely,

Richard T. T. Forman
PAES Professor of Landscape Ecology

cc: B. Alverson
H. Iltis
S. Solheim

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* E.g., Forman, R. T. T., and M. Godron. 1986. Landscape Ecology. New York: John Wiley & Sons. 619 pages.

University of Florida
Institute of Food and Agricultural Sciences
School of Forest Resources and Conservation
DEPARTMENT OF WILDLIFE AND RANGE SCIENCES
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October 8, 1986

Messrs. B. Alverson
H. Iltis
S. Solheim
D. Waller
Department of Botany
Birge Hall
University of Wisconsin
Madison, Wisconsin 53706

Gentlemen,

Thank you for your stimulating letter of several months back wherein you asked for my opinion regarding the necessity of large blocks of forest set aside as reserves for the protection of biotic diversity. Even though I do not know the specifics that pertain in Wisconsin National Forests, I do have first hand experience in Wisconsin forests in general. Therefore, I will initiate my comments with generalities that I think apply country-wide.

Overall, I believe the U.S. Forest Service is a highly professional and prestigious group; in my judgement, Forest Service Lands are the best managed public lands in the United States. I am cautious about making strong generic or blanket statements regarding either the agency or its personnel because of the threat of hurting many sincere hard-working professionals whom I consider my friends. Frankly, they don't need our criticism, they need our help.

In my judgement the Forest Service has fallen prey to the forest products industry and for too long there has been no significant difference between U.S.F.S. and industry foresters, nor the management of USFS lands and forest industry lands. In my view, forest industry has been the principal, if not the only, friend of the Forest Service in times of crisis. It makes perfect sense that the two groups should now be totally aligned against what is perceived to be attack by an alien but loud minority. I believe the U.S.F.S. has made, is making, and will continue to make significant changes in the right direction. However, we continue to lose ground daily in the struggle to maintain biotic diversity on United States public lands and I see it as anybody's guess as to whether the agencies can change 81 years of policy sufficiently quickly to stave off the loss of biotic diversity that we all so dreadfully fear.

COLLEGE OF AGRICULTURE AGRICULTURAL EXPERIMENT STATION COOPERATIVE EXTENSION SERVICE
SCHOOL OF FOREST RESOURCES AND CONSERVATION CENTER FOR TROPICAL AGRICULTURE

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In my view the wildlife profession has been unwittingly participating in the demise of biotic diversity in this country and abroad because of its trenchant adherence to the principles of game management and quick-fixes such as "the edge effect." In our zealous efforts to simplify wildlife ecology and management so that anyone and everyone can do it, we have inadvertantly got everyone thinking that they are doing it. As a consequence, I believe that by and large, the U.S.F.S. is getting poor advice, even from Wildlife Specialists. Despite catastrophic cuts at the field level, the USFS maintains a small cadre of top-of-the-line wildlife biologists.

Now to the issues of interior species and the necessity of large, unroaded blocks of forest. In my judgement we are losing two distinctly different types of animal species. Yes, we are losing forest interior specialists. These species do require large blocks of old-growth etc. I refer to these as "alpha" species in homage to Whittaker who so designated one component of diversity. But there is another type of animal species that requires very large expanses of land for day-to-day movements. Indeed, they require entire landscapes, but fortunately these tend to be habitat generalists. Because they are products of the landscape but have few identifiable specialized habitat needs, I refer to them as "gamma species" (sensu Whittaker gamma diversity). Take for example, a single Florida panther male may range over 150,000 acres. Lord only knows the area necessary for a minimum viable population of them. Luckily, they seem to do quite well in a large number of primary and secondary habitat types.

In my view, road construction and open access has been equally inimical to both these types of species. Indeed, it has been so effective at eliminating these species from our landscapes that numerous braggarts can acclaim, "lucky we don't have any endangered species on our forest!"

But it doesn't have to be this way. I believe that core areas of forest of sufficient size to accommodate the habitat specialists must be left. I do not believe it is possible to set aside large enough areas to accomodate the wide-ranging, generally top carnivore, gamma species. I believe that we must compromise and allow low intensity land uses such as responsible forestry and grazing in the area surrounding the "hard-core" areas.

Now it comes down to roads and access. I believe that numerous areas are being roaded at great cost to the public. This is pushed by industry that claims it needs public-owned wood at below-cost sales prices. Numerous other effects are lagged in time and in space and go under the heading of cumulative impacts. I believe these effects are serious, and I believe they have not been addressed in accordance with NEPA and other laws. However, I also believe these effects can be managed and mitigated.

In my personal view, road closure and very strict prohibition of access will suffice to minimize most of the negative effects that I am aware of. For example, it is pretty much a certainty that hunters, poachers, arsonists, et al. will not depart very far from roads.

There is yet one more issue that derives from my own analysis since my 1984-85 publications on these topics. This issue is that of propinquity (paper to be given at Conservation 2100 conference, New York, Oct. 1986). Propinquity refers to closeness in space and in kinship relations. In my experience it is absolutely essential to prevent alienation of the near-by people who grew up in, identify with, love, and cherish "their" land and kindred patrimony. I believe this is the most compelling reason for us to not close areas totally nor exclude low intensity use. We simply must maintain the sense that our public acres belong to the public. That generally translates into the folks that live nearby and not some amorphous abstraction that occurs in Milwaukee, Miami, Washington, or Waubbegon. In certain rural areas here in the Southeast we cannot move much faster nor push any farther (say with regard to red-cockaded woodpeckers or panthers or red wolves) until our public education and public relations improve. The Multiple-Use-Module idea is the only one I foresee working in the immediate future. This allows the hard core habitats for habitat specialists and maintains large roadless tracts for low intensity land use to maintain the local public support that we so badly require.

I hope these judgements are of use in your efforts. Your cause is worthy of great effort.

Sincerely,

Larry D. Harris

Larry D. Harris
Professor

LDH/cr

UNIVERSITY of PENNSYLVANIA

Faculty of Arts and Sciences
Department of Biology
Leidy Laboratory of Biology
Philadelphia, PA 19104-6018

17 November 1986

Mr. Stephen Solheim
Department of Botany
University of Wisconsin
Madison, Wisconsin 53706

Dear Mr. Solheim:

I have read carefully your summary position on the Chequamegon National Forest Plan, accompanying your letter of 22 September, and I have read your statement on Forest Fragmentation (25 February 1986). I grew up as an ecologist, hunter, fisherman and trapper in the fragmented forests of central Minnesota, and am intimately familiar with the ecology of your situation - though today my ecological and conservation efforts are directed at the scientific establishment of permanent tropical forest reserves.

To be blunt, you are wasting your time with forest blocks less than about 50,000 hectares. In extreme cases, blocks as small as 30,000 hectares have some chance of long term survival, if they are roughly circular in area, and if they are not based on a piece out of a long continuous habitat such as a river. The obvious object of the exercise is to conserve not only the species in the block, but their interactions, which in turn will be an essential part of the resource used by yet other species. Edge effects are horrendous, with wind, sun, weed species, winter cold, parasites and predators penetrating up to 5 km into the patch - this means that at least 25% of the patch, and sometimes as much as 50% of the patch, is expended simply as a buffer between the core old growth area and the surrounding agroscape.

There is a strong temptation to forget that the goal is the encouragement and maintenance of a habitat patch approximating that which greeted the first settlers. We cannot have the forest bison, forest caribou and the passenger pigeon back, but we can probably get almost everything else. This is not for nostalgia; we desperately need to understand how mature ecosystems function, and every road, every forest edge, every clearing, is a wall between us and that understanding. These forest patches will be very poor habitat for deer, for example; that is the way it should be. Deer are largely weeds. The birds, the insects, and their interactions with tree crowns, are grossly different in the mosaic habitats generated by small regenerating forest patches, from the fauna and its interactions in the canopy of intact old growth forest. Tree falls, densely shaded understory over many hectares, dying trees, uneven age representation, and the species composition that comes after many decades and centuries of competition all generate special habitats that are today rare and that are maintained rare or non-existant in small forest blocks.

While it is all very good for picknickers, flower watchers and hunters to have lots of edge and small patches, what they want is an eternal external threat to an integrated old growth forest approximating pristine forests. The world has to be zoned, into much for the people who want and use the products of disturbance, and a few large patches for those who wish to understand

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how an old-growth forest ecosystem functions. I might point out that all the complexity and diversity so much talked about in tropical forests is largely based on relatively pristine forest, rather than simply on the tropics. I see many suggestions that if we had some large blocks of northern old growth forests, we would be documenting interactions just as fascinating as those being exposed in the tropics.

Humans love to eat things. Edges and patches are full of what we eat. Big blocks of old growth are shady deserts. We need understanding for much more than to fill our stomachs. We need to save diversity, but remember that when it comes to forests, perhaps the biggest division of all is that between old growth or pristine forest, and all the various ages of human-generated fragments of regeneration. To discard one half of that division, is to cut your diversity by 50% from the start, no matter how long or short are the lists of species present.

Sincerely yours,

Dan Janzen

Daniel H. Janzen
Professor of Biology

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ROBERT M. MAY, *Chairman*
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October 1, 1986

Dr. Bil Alverson
Dr. Stephen Solheim
Dr. Donald M. Waller
Department of Botany
132 Birge Hall
University of Wisconsin
430 Lincoln Drive
Madison, Wisconsin 53706

Dear Drs. Alverson, Solheim, Waller:

I am writing in reply to your letter of 28 September, asking for comments on your "Statement of Reasons" for setting aside larger areas of biological reserves within two of the National Forests in Northern Wisconsin. I have read these draft statements carefully, paying particular attention to those aspects where I am most knowledgeable (having to do with diversity, population dynamics and minimum viable population size, patch dynamics, and -- most importantly -- hazards associated with fragmented forests and the need for large pristine chunks). I think your statement is an exceedingly scholarly and cogent one, dealing with current thinking about a series of difficulties used in a clear, accurate and honest way. I think you are particularly to be commended for your accurate identification of our lack of good understanding of exactly how large reserves have to be in order to serve their designated function, along with your emphasis on the proven inadequacy of small, fragmented reserves. As you observe, recent work on a detailed experimental kind on the courses of predation on neotropical migrant birds in fragmented forest patches in Maryland testifies eloquently to the necessity for large core areas (and testifies equally eloquently for the dangers of areas whose small size necessarily creates large edge-to-core areas).

It is, as you observe, a sad fact that we simply do not yet know enough about exactly how large a reserve needs to be, in order to preserve its original set of floral and fauna. The only thing we do know with certainty is that many exceedingly large reserves have proven to be insufficiently large, with local explosions of populations and other peculiar dynamical behavior being manifested, even when the reserves are on the scale of 10,000 hectares or more.

In short, I think your statement is an exceedingly cogent and accurate one, and I am in complete agreement that there is scientific need for some areas of this size to be preserved. This scientific need is altogether separate from the different arguments that can be made on ethical, esthetic or recreational grounds, and I have no special expertise to address such questions. But I do most firmly believe, purely on the issues of better scientific understanding and future management, that the need for sequestration of large reserves of the kind discussed in your statement is of great importance.

If there is anything else I can do to be helpful, please let me know.

Yours,

Robert M. May, F.R.S.
Class of 1877 Professor of Zoology

RMM/clh

Missouri
Botanical
Garden

August 4, 1986

Dr. Hugh H. Iltis
Director of the Herbarium
Department of Botany
University of Wisconsin
132 Birge Hall
430 Lincoln Drive
Madison, Wisconsin 53706

Dear Hugh:

I have examined the document by Stephen Solheim and William Alverson entitled "Forest Fragmentation and Island Biogeographic (IBG) Management," and it is my considered judgment that this is a well-conceived and potentially effective plan that would serve to protect the biological diversity of the Chequamegon and Nicolet Forests. As you have brought out, old growth of the sort that was present before European settlement in Wisconsin has largely been destroyed, and it is in the interest of the citizens of Wisconsin, as well as in the interest of all Americans, that the opportunity be given for the restoration of this vegetation type. Ecological studies throughout the world are showing, with increasing effectiveness, that old-growth vegetation is necessary for the breeding and survival of many kinds of plants and animals. The kinds of second-growth situations that are characteristic of many of our natural forests and, even more so, of altered or exploited lands are simply not adequate to protect populations of these organisms adequately. A large block of old-growth forest, undisturbed and able to recover to its original status, is, therefore, of critical importance for each major vegetation type in the United States. Since the areas in question are already protected as National Forests, the cessation of fragmentation of vegetation types within them and the opportunity for recovery by biological diversity is a step that can be taken now, but which will be increasingly difficult in the future, as the fragments of vegetation concerned become more and more isolated and altered under the pattern of continued land use.

I understand that you are by no means arguing that this large block of undisturbed habitat occupy anything like the entire areas of the National Forests concerned, but rather that some particular blocks be set up so

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that those plants, animals and microorganisms which depend on such vegetation for their survival be allowed to recover. Doubtless, there are many kinds of organisms in these forests that are insufficiently known to document fully their dependence on large blocks of undisturbed forests for recovery, and the chance to set up such blocks while this can still be done effectively should not be missed. Based on my general knowledge of ecology and the principles involved, it is a very great pleasure for me to endorse strongly the plan that Mr. Solheim and Mr. Alverson have developed in this important area.

With all good wishes to you, I am

Sincerely,

Peter

Peter H. Raven
Director

PHR/dgk

The Florida State University
Tallahassee, Florida 32306-2043

Department of Biological Science

October 2, 1986

Mr. William Alverson
Mr. Steven Solheim
Dr. Donald M. Waller
Department of Botany
132 Birge Hall
University of Wisconsin-Madison
Madison, WI 53706

Gentlemen:

I write in response to your letter of September 22, which I have just received Monday, September 29. I have read through your statement on the Chequamegon National Forest plan. Since this is precisely the matter I have thought about for a long time, particularly with respect to the Apalachicola National Forest here in Tallahassee as well as a series of National Forests in Regions 5 (California) and 6 (Pacific Northwest), I am glad to discuss this matter with you, although I am of course somewhat hampered by not having detailed information on Chequamegon. Of course, since part of the problem is that no one has sufficiently detailed information on Chequamegon at this time, perhaps I am not at such a disadvantage. At the outset, I would be curious to know specific examples of a point you raise in your letter, namely, that my publications critical of the application of island biogeographic theory to nature reserve design have been misinterpreted and used by some to thwart conservation efforts. When? Where? By whom?

I ask because it is difficult for me to imagine how my writings would be properly interpreted to suggest in any categorical way that there is no need for very large blocks of natural reserve. In a nutshell, I have consistently said that no generalization is possible here, and that in every instance the specific communities and species of concern must be studied in detail. This research has been undertaken in very few locations. To my knowledge it is not available for Chequamegon. In the absence of such information, it would be folly to suggest that scattered reserves of 100, 500, or even 2000 ha will suffice to maintain the forest communities. The papers in Forest Island Dynamics in Man-Dominated Landscapes by Levenson and by Ranney et al. on forests in southern Wisconsin demonstrate the sorts of work that must be done to determine the nature of edge effects, and in particular how far into a forest edge effects seep. Janzen, in the island symposium in Oikos, suggests that these effects may go a lot further, than people suspect, even people who have used the methods of Levenson and of Ranney et al. The gist of his argument is that they have focussed on micormeteorological changes at an edge, whereas the effects of changing the relative propagule frequencies in the interior will take longer to be manifested but may well be devastating to the interior forest, over the long term.

In addition to edge effects, there may well be species whose minimum viable population size requires huge amounts of land. For example, I have recently served on the Audubon Society's Advisory Committee on the northern spotted owl. Having heard testimony from all the primary researchers in the field, I can say unequivocally that this bird requires home ranges of old growth forest ranging from 2000 acres/pair in California to 4,500 acres/pair in Washington. The committee could not state with assurance what a minimum viable population would be for this species, but there was unanimity that it is more than 500 pairs. Thus, to conserve the spotted owl, there will certainly have to be stands of many thousands of acres, or at the very least rather dense collections of stands of a few thousand acres. My point in going into this example is to note that the research required to establish these requirements for the spotted owl took several years by several dedicated, well-funded groups. And this is for one species only. What sort of analogous research has been performed on the plants and animals of Chequamegon? I would also point out the World Wildlife Fund's long-term study of rainforest, in which reserves running from a few ha to more than 10,000 ha have been established for long-term monitoring of floral and faunal changes. This is exactly the kind of research that will be required to establish exactly what sorts of changes will occur in exactly what size blocks of forest, but, to my knowledge, there is no other controlled experiment of this sort being conducted in any other kind of forest.

There are, of course, certain kinds of ecosystems that can only be maintained in very large areas--entire watersheds, etc. And there are certain interactions between the physical environment and various species that cannot occur in small refuges. In Florida, for example, many of our forests are fire-adapted and the fires in very large forests are characteristically different from those in small forests.

It is certainly true that there is empirical evidence on a variety of systems showing a decay in number of species through time when area decreases, more or less to the number predicted by the standard species-area relationship. However, I would argue, as you do in the statement that you sent me, that simple focussing on the area can be very misleading--the key is that the area be of the appropriate habitat. From my experience in national forests both in the Northwest and in Florida, I would beware of Forest Service statements that X ha of a certain type of forest are part of a particular forest plan. When examined closely, these are sometimes duplicitous. For example, several individual forests in Regions 5 and 6 were indicated on maps presented to the spotted owl committee as areas suitable for owls and being managed for old growth. Detailed probing determined that some of them had recently been clearcut and were on a planned 300-year rotation, thus earning the designation, "managed for old growth." To reiterate, "area" should mean "area of suitable habitat" in discussions founded on the species-area relationship.

My sole qualification to your statement would be to proposed criterion 4, regarding the desirability of corridors connecting IBG areas. In the abstract, this sounds fine, but several points must be established: (a) Will the species actually use the corridors? (b) Is there evidence for particular species that genetic depauperation presents either a short- or a long-term problem? (c) Is there a possibility that the corridors will become conduits for introduction of allochthonous species into the forest community (that is, corridors produce an enormous amount of edge)? d) Will the corridors be managed in such a way as to prevent traplining by humans or other predators of animals that might use them? I would beware of how corridors are integrated into the plan. In Florida we already have examples of some governmental enthusiasm for corridors on the grounds that they are relatively inexpensive and some politicos have now asked if a collection of small refuges well-connected by corridors might suffice instead of large refuges. My own view is that edge effects alone show that this is not a viable substitution, but obviously more work will be needed.

I feel uneasy that I am talking in generalities rather than specifics, but that is exactly the reason why some very large natural areas must be set aside now--the research that would establish just how small sites can be has not been performed, and empirical data on other systems certainly does provide many examples where large sites are absolutely necessary.

If you would like amplification of any of these points, please feel free to write or call.

Sincerely yours,

Daniel Simberloff

Daniel Simberloff
Robert O. Lawton Distinguished Professor

DS:cgg

The Society for Conservation Biology

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September 30, 1986

Dr. Donald Waller
Department of Botany
University of Wisconsin-Madison
Madison, WI 53706

Dear Dr. Waller,

I aplogize for this tardy response to your request for comments on the position paper "Forest Fragmentation and Island Biogeographic (IBG) Management." I hope that my remarks will be of some value.

Supporting large reserves these days is like supporting motherhood. The overwhelming consensus among ecologists and biogeographers is "the larger the better." The larger the reserve, the more kinds of interactions can occur, and the more species will reach the threshold of population viability. Jared Diamond, Dan Simberloff, E. O. Wilson and many others all agree on this central tenet of conservation biology. Geneticists have their own reasons for pushing bigness, as recently reviewed in "Conservation Biology: The Science of Scarcity and Diversity." In addition, several chapters in this book discuss edge and area effects, and these are directly relevant.

In the absence of precise data, we must be conservative, erring, if at all, on the side of caution. It is difficult for anyone to say at this time whether areas the size of 200 km^2 in northern Wisconsin are "the right" size. We cannot arrive at such conclusions in the abstract. Specific interactions and particular species will eventually have to be considered. And much depends on the managment goals. After all, Yellowstone is too small for the grizzly.

If I had to guess, however, I would guess that a patch of "wilderness" that could be traversed on foot in an hour or two is much too small to be free of profound edge effects, especially those that are related, directly or indirectly, to human activities including hunting, trapping, and logging.

Sincerely,

Michael E. Soule,
President, pro tem

THE WILDERNESS SOCIETY

October 2, 1986

Mr. Bil Alverson
Mr. Stephen Solheim
Dr. Donald M. Waller
Department of Botany
University of Wisconsin-Madison
132 Birge Hall
430 Lincoln Drive
Madison, Wisconsin 53706

Gentlemen:

I thank you for the opportunity to comment on your proposal to establish large "island biogeographic" reserves in the Chequamegon and Nicolet National Forests. For the past six years I have been studying island biogeographic theory and its applications to the design of nature reserves. More recently, I have become heavily involved in the national forest planning process. I therefore consider myself well qualified to speak about your proposal.

A substantial body of empirical data supports your belief that large blocks of natural forest are necessary for the conservation of a variety of plant and animal species. In the case of forest-dwelling songbirds, we have observed population declines in woodlots as large as 3000 ha (Robbins 1979). In contrast, populations of these birds within the much larger Great Smoky Mountains National Park have been relatively stable. These findings have led me to conclude that forest reserves on the order of 10,000 ha or more may be necessary to ensure the long-term viability of populations of forest-dwelling songbirds (Wilcove 1985, Whitcomb et al. 1976). Of course, songbirds are only one part of the forest biota, and other species may have larger or smaller area requirements.

Other benefits of large forest tracts include the following: (1) they fulfill the minimum area requirements for many of the large raptors and mammals. These species have vanished from many parts of their range as a consequence of habitat fragmentation (Burgess and Sharpe 1981); (2) they have greater internal natural habitat heterogeneity, which may be important to the survival of some species (Wilcove 1986); and (3) they have a high proportion

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of protected forest interior to forest edge (if more-or-less round in shape).

I believe that the national forest planning process provides us with a tremendous opportunity to actually plan how habitats will be altered, rather than salvaging the remnants of thoughtless development. It is essential that we incorporate island biogeographic principles into the planning process, and I am pleased to support your efforts to do so.

Sincerely yours,

David Wilcove

David Wilcove, Ph.D.
Ecologist

DW/jr

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Center for
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November 18, 1986

Drs. Bil Alverson, Stephen Solheim,
and Donald M. Waller
Department of Botany
University of Wisconsin-Madison
132 Birge Hall
430 Lincoln Drive
Madison, Wisconsin 53706

Dear Drs. Alverson, Solheim, and Waller:

Thank you for bringing to my attention the proposed management plans for the Chequamegon and Nicolet Forests. I have reviewed the several documents describing your position regarding the Forest Plans.

I am in thorough agreement with your concern for forest fragmentation and the related problems. The need for large, undisturbed tracts of forest in order to maintain their natural integrity and diversity is fundamental. Precisely how large and intact depends of course on the particular forest, although contiguous tracts on the order of tens of thousands of acres are clearly called for in many instances. The overwhelming scientific evidence that the reduction in size and fragmentation of habitat is the major single threat to diversity in natural ecosystems very clearly compels land management agencies to consider the maintainence of intact forest first priority. If substantial reduction and isolation of tracts, or disturbance of tracts is considered, than the agencies bear the burden of planning and implementing procedures to mitigate the effects.

Fragmentation of existing forest tracts, or dissallowing recovery of disturbed tracts (e.g. tracts consisting of a mosaic of early successional stages) that are likely or potentially important for maintaining viable populations of area-sensitive and fragmentation-sensitive species is contraindicated in the absence of reasonably detailed consideration of the potential consequences and their remedies. Such consideration must incorporate the available scientic information bearing on the resource in question. This means of course examining data on the abundance and distribution of species and their habitat requirements in view of current theory in conservation biology. In this instance, this includes especially an examination of these data in view of island biogeographic and population viability considerations.

Theoretical constructs from island biogeography, population ecology, demography, and population genetics are as fundamental to forest planning as are theoretical constructs from biomedical research to human medicine. I would further stress that this same body of theory should direct the selection of indicator species and the planning and implementation of monitoring programs aimed at protecting diversity.

A final point which was raised in one of your documents needs emphasis. The term "diversity" refers generally to natural diversity; the natural distribution and abundance of biological elements (ecosystem types, species, populations, and the genetic diversity they contain). Thus, the manipulation of habitat for other purposes that incidently enhance "diversity" in terms of the variety of, say, seral stages, is not a legitimate approach to the problem of maintaining natural diversity in forest ecosystems or any other types ecosystems. As has become abundantly clear from the numerous scientific, policy, and legislative activities relating to this issue over the past decade or more, the issue is that of preventing the loss of native plants, animals, and ecosystems, and with them the enormous direct and indirect economic benefits. Furthermore, since elements of biological diversity are irreplaceable resources, providing for diversity in National Forests is not just another multiple use objective; the diversity inherent in national forests is the forests!

Please let me know if I can be of any further assistance.

Sincerely yours,

Bruce A. Wilcox
Executive Director

BAW:com

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MUSEUM OF COMPARATIVE ZOOLOGY
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4 August 1986

Professor Hugh H. Iltis
University of Wisconsin-Madison
Department of Botany
132 Birge Hall
430 Lincoln Drive
Madison, Wisconsin 53706

Dear Professor Iltis:

As one of the original developers of island biogeographic theory and with a continuing interest in the effects of the geometry of reserves, I can fully endorse your plan to set aside large blocks of land in the Chequamegon and Nicolet National Forests as biological reserves. They will indeed be different in properties from an "archipelago" of smaller reserves.

Sincerely yours,

Edward O. Wilson
Baird Professor of Science

EOW:kmh

Dr. **Waller.** Anyway, my general point is that the Federal agencies take inconsistent actions, that there is often a misunderstanding or misinterpretation of science and its terminology, a lack, in other words, of institutional resolve to face up to their responsibilities to preserve and enhance biological diversity.

That is not to say that there are not a great many individuals within those organizations who are top-notch scientists and who are working actively themselves to further these goals. It is simply that we lack this coordination that your bill is directed towards to achieve the goal of preserving biological diversity.

I think your bill makes rather modest demands. Is it really too much to ask for a formal coordination among Federal agencies and between scientists and agencies?

I would like just to end by saying, before I get into my comments for specific amendments I would like to suggest, I would like to emphasize this importance of integrity, this importance of credibility.

It has been very disappointing to me to interact with a Federal agency that seems to lack this concern for biological diversity and input from the best scientists in the country on the issue. I think it is very important to exercise leadership on this matter. Your bill would provide a mechanism to allow that leadership.

It is in our self-interest to pursue biological diversity as a goal. We need to do it in the most efficient and rational way possible. It has widespread support. It is a bill that is long overdue.

Federal agencies first of all need to ask for scientists' input. It is just another example, if I can wander on. I have been quite concerned with some of my colleagues in doing research on white cedar swamps, and they contain a great many rare plants in our State, and they are an endangered community within our State because white cedar is not reproducing, again because of deer, we think.

Mr. **Scheuer.** Again because of what?

Dr. **Waller.** Because of white-tailed deer overbrowsing the seedlings and saplings of this conifer, the same way they do Canada yew and eastern hemlock.

Mr. **Scheuer.** Yes.

Dr. **Waller.** I called Tom Crow at the Rhinelander office of the Forest Service—he is in charge of the biodiversity project in the Midwest—on March 6 or 7 to find out that there was a March 1 deadline for the Forest Service to accept proposals for research that would have provided up to $50,000 worth of matching support.

Now, I considered it a little odd that I as a chief actor in biological diversity issues in the State of Wisconsin was neither advised nor appraised of anything about this program, in particular its deadline.

Mr. **Scheuer.** Excuse me. How did they get out notice of the deadline?

Dr. **Waller.** I have no idea. I contacted a colleague in forestry. The forestry department at the University of Wisconsin was also not notified of this research initiative. They also had interest in doing research within the State. Again, it is a lack of institutional resolve and substantial input. I don't know, it may be a bureaucratic mixup. I am not pointing any fingers at any one individual.

What I am saying is that this sort of thing deserves to be well publicized. They are doing inhouse research that should be——

Mr. **Scheuer**. Yes, it seems to me that the number of actors is fairly small. It's not as if they are going to have to mail notices to 242 million Americans. I suppose if they had mailed a couple of hundred notices, that would have gotten most of the people.

Dr. **Waller**. Or perhaps one or two ads in the leading journals in the field.

Mr. **Scheuer**. Yes. And if they published a notice in some remote weekly, I would consider that a little bit disingenuous and not quite a forthright way of dealing with the interested groups. It isn't that difficult in this age of telecommunications to get out the word to a few hundred or a few thousand interested groups.

Dr. **Waller**. I can only agree. And we do need to work towards consensus. And there is consensus emerging within the scientific community. We have some tools. We have general agreement on the importance of large areas, on the importance of——

Mr. **Scheuer**. The importance of what?

Dr. **Waller**. Of large areas.

Mr. **Scheuer**. Yes.

Dr. **Waller**. For conserving biological diversity and intact communities that aren't fragmented into small pieces.

Mr. **Scheuer**. Well, I mean experience has proven that the whole business of relying on identifying single endangered species is an exercise in delusion. First of all, they are subject to all kinds of administrative delays, sometimes legal attack, and by the time you have taken five, eight, ten years to declare a species endangered, it's gone or it's traveling down the slippery slope at such a rapid pace that it is virtually impossible to save it.

I think that there is a general consensus that in most cases the approach of the Endangered Species Act is really an exercise in futility and that what we have to do is preserve habitats. Now that doesn't mean that that has to prove to be an interference with normal business practices.

Dr. **Waller**. No.

Mr. **Scheuer**. If lumber companies really value their asset, their capital asset, which is a stand of timber many miles square, they will harvest that timber on a sustainable yield basis. Nobody is suggesting that much of the time we say this particular lot or tract of land has to be pristine. That may be once in a while appropriate, but most of the time we would say don't kill the goose that laid the golden egg, don't destroy this capital asset, preserve the capital asset for your lumber company, for the public, for our future, for generations yet unborn.

Dr. **Waller**. And as an aside, I would just like to add that in the case of the Chequamegon forest we had agreement from the Forest Service staff, including the supervisor, Mr. John Walter at that time, that our proposal to set aside a couple of these large, as we called them, diversity maintenance areas would in no way interfere with the economic outputs of that forest.

We, the scientists and the conservation community as well, have no disagreement with our need to produce timber and other outputs of our national forests. But here was a case in one national forest in Wisconsin to have our cake and eat it too, to set aside a couple of these areas for the maintenance of diversity, to study the issue and maintain exactly the same output as the plan originally called for.

This plan, not through the action of this forest staff, but through the regional supervisor, the plan was reversed. That is, that plan to protect diversity maintenance areas, it was a purely administrative move, a bureaucratic move, made without any scientific or economic analysis, apparently in direct response to timber lobbying efforts.

Mr. Scheuer. Well, I do want to hear from some of the other witnesses. And I have no problem with the timber lobbying efforts, you know. Under the Constitution we are all guaranteed access to the Congress, access to Government, and lobbying is a perfectly legitimate activity.

Dr. Waller. Well, maybe I could finish with one last example.

Mr. Scheuer. Oh, yes, please do.

Dr. Waller. Regional Forester Henson, in transmitting Hal Salwasser's paper on how to analyze minimum viable populations, population viability analysis, included a cover letter to his forest staff that directly discounted the value of that document, in effect told them to ignore it, by saying that it was a question of risk, of probabilities, and as he put it, allowed that this document from Salwasser could allow them to streamline the process of compliance with the diversity requirement.

Now here is a case where a scientist in good faith, an able man within the Forest Service, is having his own science marginalized by decisions being made within the structure. I consider that to be scandalous.

Mr. Scheuer. Yes.

[The prepared statement of Dr. Waller follows:]

Testimony of Dr. Donald M. Waller on behalf of the Sierra Club before the House Science & Technology Committee's Subcommittee on Natural Resources, Agriculture Research and Environment in favor of **H.R. 1268, the National Biological Diversity Conservation and Environmental Research Act**. (17 May, 1989)

I speak today both as a professional ecologist and on behalf of the Sierra Club. The Sierra Club joins a wide spectrum of environmental organizations and the scientific community of conservation biologists in fully and enthusiastically supporting Rep. James Scheuer's bill, H.R. 1268. We urge both the House Science and Technology Committee and the Merchant Marine and Fisheries Committee to rapidly approve this bill and support its passage by Congress.

Over the past 20 years, Congress has helped the United States to make great strides in improving environmental protection, particularly of our physical environment - the air and water. We have been less successful in protecting our biological environment. We have, however, reached consensus on the importance of protecting and restoring our diverse and sensitive biological environment. Scientists, environmentalists, and the Office of Technology Assessment now all agree that maintaining biological diversity, including genetic diversity, is a vitally important conservation priority for many reasons that I do not have time to reiterate. Biological diversity is also our most challenging conservation issue. Biological diversity is our most irreplaceable resource - we can never recover the races and species we are losing. Diversity also, surprisingly, remains one of our least studied resources. We lack thorough and systematic inventories of even species presence across our national lands; this ignorance is compounded when it comes to their biological requirements. We also lack the resources to reliably monitor populations of the vast majority of these species. Thus, we find that one of the most vital links in our chain of environmental protection also remains the weakest. To efficiently and effectively maintain our nation's rich set of biological resources will require broad-scale and coordinated action on the federal level.

In this same past 20 years, considerable new knowledge and understanding of ecological processes has emerged. Biologists now understand the importance of maintaining natural habitats arranged in larger blocks and/or connected together in ways that allow the processes and interactions that sustain their constituent species to proceed unimpeded. We have learned that fragmented habitats usually function poorly to maintain biological diversity due to a wide variety of intrusions and disruptions and interrupted gene flow. Out of many, seemingly unrelated, investigations has emerged a remarkably coherent set of principles within the new discipline of conservation biology. These principles form the foundation for an evolving, yet already effective, set of scientific tools we can use to protect species and genetic diversity. Rep. Scheuer's bill would do much to enhance both the development of this knowledge and its integrated and effective application throughout the federal government.

It might be assumed that protecting biological diversity is already a high national priority well supported through various public agencies and particularly the Endangered Species Act. This is, in part, true. Many of our federal land management agencies have the conservation of diversity as a high priority, and the Endangered Species Act has been essential for protecting those very vulnerable species recognized to be on the verge extinction. Unfortunately, however, the Endangered Species only enables protection species-by-species at a time when "intensive care" rescue efforts are necessary and often cost Such an approach leaves largely unprotected a vast reservoir understudied species, including some 20,000 species of plants far more invertebrate species in the continental U.S. alone. This law protects species retail, not wholesale. Rep. Scheuer's bill provides simpler, more systematic, and ultimately more effective programs that would complement the Endangered Species Act by helping species to avoid further threats. As with health, it is ultimately far more effective and efficient to pursue preventative measures. This bill would also provide information at early stages to land-use planners that would help prevent confrontations over particular threatened species, often discovered late in the planning process. Thus, H.R. 1268 and the coordinated and comprehensive approach it would foster are both biologically and procedurally superior to current measures.

The federal agencies entrusted with managing our national lands present a different set of opportunities and constraints. Often, these agencies have been plagued by a variety of conflicting demands that have sometimes prevented them from effectively protecting biological diversity. The National Park Service has been a leader worldwide in protecting spectacular scenery and lands for recreation. Only recently and rather unsuccessfully, however, have they moved to secure representative pieces of missing habitats, such as the Tallgrass Prairie, the most completely obliterated biome of North America. Our National Wilderness Preservation System has done an excellent job of protecting badly needed habitats for many species, but often occupies areas of "rocks and ice" that can not adequately protect species endemic to other areas. Our National Wildlife Refuge System also protects many species, especially migratory waterfowl, but is also not designed to protect diversity comprehensively. Finally, a miscellany of other federal initiatives exist to protect such ecosystems as barrier islands, marine and inland wetlands, coastal lands, wild and scenic rivers, and marine sanctuaries, yet these fragmented programs lack a broad and coordinated vision to protect their constituent biological diversity.

Existing programs within federal agencies also fail to tackle problems associated with maintaining biological diversity in a consistent and effective manner. Each agency has historically approached conservation within the context provided by its own institutional prerogatives and structure. This occurs even within the one agency explicitly directed by Congress to protect diversity. The 1976 National Forest Management Act directed the U.S. Forest Service to "preserve and enhance" the natural diversity of our National Forests. Over the past three years, I and several other biologists have been engaged in intense consultation with the staff of Wisconsin's two National Forests in an attempt to provide clear and simple prescriptions from contemporary conservation biology to protect diversity within these National Forests (see Endangered Species Technical Bulletin reprint attached). Yet, sadly, despite these attempts, the explicit language in the NFMA, and supportive statements from a score of the country's top experts in biological diversity, the Forest Service has continued to resist applying concepts from conservation biology in managing these National Forests. Instead, they have viewed diversity as a hostile threat to their style of management, choosing to misinterpret the diversity mandate to mean the establishment of a variety of timber age classes in the Forests. They have also failed to acknowledge their responsibility to protect native species most vulnerable to extirpation and have ignored or repudiated statements from their own and outside biologists regarding how to manage forests for diversity and assess population viability. Clearly, this agency lacks institutional commitment to the goal of protecting biological diversity and respect for the integrity of conservation science.

Thus, many institutional barriers exist that prevent the application of accepted scientific principles to the goal of protecting biological diversity. Rep. Scheuer's bill, H.R. 1268, provides an integrated and unified approach to fill the biggest gap that now exists within our umbrella of environmental protection measures. Its strengths include:

- comprehensive findings that lay out the case for the proposed programs, as well as scientifically sound definitions and purposes

- vital, explicit language for the National Environmental Policy Act that will focus needed attention on biological diversity within the environmental assessment process

- the establishment of a National Center for Biological Diversity with enhanced research into the processes that maintain diversity at all levels. The information resulting from this research will improve land-use planning at all levels of government and in the private sector.

- the establishment of an Interagency Working Committee on Biological Diversity and the preparation of a federal strategy to protect biological diversity.

We would like to strengthen this bill, however, by proposing three additions to the bill:

1) The term "species diversity" defined in Sec. 3 (5) should be restricted to refer to "the richness and variety of native species that inhabit the world or a particular location in the world." Species not native to particular locations (e.g. aggressive weeds) already represent a significant threat to native species and community diversity and should by no means be included in any protective measures fostered by this bill.

2) A sentence should be added to Sec. 5(c) to require that all federal lands be managed to protect biological diversity, particularly areas on which diversity is especially threatened. In constructing the strategy required in Sec. 8, a special focus should be given to this requirement.

3) The composition of the Interagency Working Committee established under Sec. 7 should be modified to ensure that the Departments of State and Treasury are involved. Environmental issues are becoming increasingly prominent within programs of the Agency for International Development and the Department of State's deliberations on international matters like the high seas, Antarctica, acid rain, and global climate. Similarly, because decisions regarding the multi-lateral development banks have substantial impacts on diversity throughout the world, the Department of Treasury should be involved in this Committee.

Thank you for your time and consideration.

Biographical Sketch - Donald M. Waller

Dr. Waller is a 37 year old professional population biologist currently employed as an Associate Professor in the Department of Botany, University of Wisconsin - Madison. His research focuses on plant population dynamics and the genetic causes and consequences of inbreeding. He has also worked to apply these concepts and techniques to analyze demographic and genetic processes occurring within threatened plant populations. Dr. Waller received his degrees from Amherst College and Princeton University, and has received research fellowships from the National Institutes of Health, Harvard University, the Smithsonian Institution, and the Alexander von Humboldt Foundation. His field research has ranged across many Northeastern and mid-Western states, as well as Mexico and Panama. He is author or coauthor of over 30 scientific papers.

Mr. Scheuer. I would appeal to the business representatives we have present, Mr. Heissenbuttel and Mr. Ford, to carry back to their industry the message that we have great respect for the sense of responsibility and the sense of integrity of American business. I am a graduate of the Harvard Business School. I have great respect for corporate responsibility. But it isn't always present.

And we have seen in the chemical industry for years that they have avoided and evaded and delayed adequate regulation to the point where our Nation is littered with toxic wastes by the tens of thousands, that we really have no confidence in dealing with because a good Wall Street lawyer, paid $300 an hour, can delay a regulation of a given chemical substance for years and years and years.

And our form of constitutional Government and our legal system simply makes regulation of the chemical industry and forest products industry an impossibility if their corporate leadership and their handsomely compensated, very brilliant and competent Wall Street lawyers are determined to frustrate the will of the people, the will of the Congress, the will of the professional scientists, the will of Government agencies.

Yes, you do have that power, Mr. Heissenbuttel. The question is, you all have kids, you'll have grandchildren when you're a little bit older, do you really want to do that to the next generations of Americans?

We have resources in our country that are on a race with time, facing utter extinction. Is that the kind of a country that we want to pass on to our kids and our grandchildren?

I really implore you to take back to your people the message that we want to work with you, we don't want to do anything silly, we don't want to cut your profits in the long run. We would ask you most of the time to manage your resources on a sustainable yield basis. Is that unreasonable?

We are open-minded. We will make whatever changes seem appropriate and necessary. We want to avoid the situation where you take constant recourse to the courts. That would utterly frustrate democratic Government. Is that what we really want?

I hope your answer is no, but to work with us in crafting a piece of legislation that leaves you pretty much intact, that may not give you everything you want but leaves you pretty much intact and provides for the preservation of your capital asset. Basically, that is what we want.

And I implore you to work with us. You will not find a more open-minded committee chairman on Capitol Hill. And the same with our staff. We are not confrontational people. We really want to solve problems. And you know, it takes two to tango. We want to work with you.

Please see if you can get the go-ahead signal at the topmost echelons of your industry from the power structure that I believe to be responsible, thoughtful people, get them to give you a green light at least in an attempt to work out these problems in a way that is reasonably satisfactory.

Mr. Heissenbuttel. If I may respond.

Mr. Scheuer. Yes, please do.

Mr. HEISSENBUTTEL. I want to be sure one of the messages that comes out loud and clear from the timber industry is that we feel we can really wear a white hat on the issue of conservation of biological diversity. As I stated in my prepared statement, we believe forest management is far preferable to any other land use or just about any other land use that there is. We have the need for forest products. We have a demand from society to produce forest products. We believe we can really do that in an environmentally sound way, and we do.

So while we agree with you on the conservation of biological diversity, we have been directed by our people who are concerned about it to participate in the Keystone process and to identify what is really needed.

So I believe our corporate managers are really concerned about it.

Mr. SCHEUER. Good. Well, we hope that the Keystone process produces consensus. But we hope you will also give us a chance to produce consensus with you on this bill.

Mr. Ford?

Mr. FORD. Yes. I would just like to state for the record that we will take that message back, and we appreciate your thoughts.

I would also like to state one other thing for the record here. The question of the Chequamegon was brought up a number of times by Dr. Waller. This is not the forum to debate that issue.

I just want you to know, and for the record, that there are two sides to the story of the Chequamegon, and that is currently trying to be resolved through a consensus dialogue process as well with both the preservationists, the environmental community and the industry in dialogue with the agency. And that is trying to get under way right now to try to resolve some of the issues that are out there.

But there are two sides of that story, and certainly if you are interested in the other side, at some other time we would be happy to give you that information.

Mr. SCHEUER. Thank you.

Dr. Cutler, we haven't heard from you in the last few minutes. We have had a big free-for-all.

I would like to ask you, is our understanding of biological diversity sufficient to enable the Council on Environmental Quality to prepare guidelines for the consideration of biological diversity in environmental impact statements?

Dr. CUTLER. Of course, the Council on Environmental Quality has been a dead duck for the last eight years. We have just heard that Mike DeLand, the current regional administrator of EPA in Boston, is going to be named the chairman of that council. Apparently it is just going to be a one-person council. But that's okay. Mike DeLand is a good man, and maybe he can breathe some life back into it.

It has been a dead, dormant agency that has had no effect on presidential policy as it was originally intended and as it was administered in a Republican administration, the Nixon Administration, by Russ Train. It had a lot of influence, and we hope it does again, and we hope Mike DeLand is successful in bringing the environmental point to bear in the White House. That is encouraging, Mike DeLand going to CEQ. Maybe CEQ can become a player again.

The answer to your question specifically do we have enough information to begin to operationalize the concept of biological diversity is, I think, yes. And the Society for Conservation Biology represents a professional society best able to respond in detail to the questions that would have to be answered following that conclusion.

I would like to respond to two things that have been said in the last few minutes if I may, Mr. Chairman. One has to do with the Keystone Center operation that many people have alluded to and you have commented on. Defenders of Wildlife is represented in that exercise as well. I have attended a couple of meetings. We will be attending another one next week.

It is my impression that the way that exercise is moving is towards an on-the-ground effort to work with all of the Federal land management agencies involved with particular ecosystems, such as the greater Yellowstone ecosystem, to try to effect better coordinated planning and management on behalf of an array of resources and the public interest rather than having the Park Service, in the case of Yellowstone, managed for tourism and the Fish and Wildlife Service managed for trumpeter swans and too many elk, Forest Service managed for timber, grazing and mining and geothermal development and all sorts of difficult private inholdings, such as the Church Universal and Triumphant, which owns the land near Gardiner in the north side of the park that cuts off the migratory route of the elk and the bison and the bighorn and the pronghorn, and creates a hell of a problem. That land should simply be acquired by the Forest Service.

But if we get out on the ground with these agencies and look at how they can interpret their guidelines and how the Fish and Wildlife Service and the Park Service, the BLM I think can profit from the Forest Service's experience in regulations and guidelines, work together, see how that indicator species process can work more effectively, how the planning process can work, get all four agencies working together, get them in turn working with local land use plans for Moose, for Jackson, for Livingston, for Bozeman, get that whole ecosystem under a coordinated planning process. We may see some advantage in terms of opportunities to protect biological diversity.

But more basically, Mr. Chairman, I would like to move from Dr. Waller's very important bottom-line comment that we need to protect biological diversity wholesale instead of retail. And you have commented on that too.

What is needed to do this in the best of all worlds, in my opinion, are three things: The first is a national atlas of plant communities and their related life forms; that is, large groups of animals that have the same habitat requirements. And the basic, the bible in this concept of life forms, was published a decade ago by the Forest Service. It is this book called "Wildlife Habitats in Managed Forests: The Blue Mountains of Oregon and Washington," U.S. Department of Agriculture, Forest Service, Agriculture Handbook number 553. Its principal author is Dr. Jack Ward Thomas, a senior wildlife research biologist for the Forest Service in La Grande, Oregon, who goes into detail on the concept of life form associations with plant communities in successional stages.

What life form does for us is to lump several hundred animal species in one kind of plant community habitat requirement. So if that habitat requirement is protected, dozens or hundreds of species are automatically protected because they all share the same habitat requirements. So that simplifies matters.

So if we knew all the plant communities/life forms in the country, in an atlas, we would have a starting point.

Secondly, an analysis of the protected status of the best undisturbed examples of each of these communities to tell us which communities and life forms are without protection of any kind, so we know which ones of these communities are endangered. Rather than speaking of endangered species, let's speak of endangered communities or endangered life forms.

Third, a program to provide explicit protection to a representative number of good examples of each community and life form where we can call them, as Dr. Waller suggested, diversity maintenance areas. This protection can be zoning, it can be easements, it can be compatible development as well as public acquisition. And it need not be wilderness, as you said, Mr. Chairman. Many species are able to live in harmony with man's activities up to a point, while some in fact do require a minimum of disturbance and extensive old-growth habitat, like the spotted owl.

Once such a habitat atlas and analysis have been prepared and such a habitat conservation program has been implemented—this in effect is one of the purposes of the American Heritage Land Conservation trust program—we would be able to feel more secure and confident about our biodiversity protection campaign. That is, we would then know which plant communities and life forms were in fact imperiled, and we could concentrate on defending them.

Mr. SCHEUER. All right. Thank you, Dr. Cutler.

Let me ask, do we need to be more specific in our legislative proposal regarding what constitutes a significant loss of biological diversity, or do the procedures that we have set up in the bill provide an adequate means to address this question? We don't want to force people or groups or individuals to be required constantly to access the court system. We want to be sufficiently specific to avoid that, to have the thing speak for itself. Do we need to do more, or is our language adequate?

Dr. CUTLER. It is a matter of perfecting the definition section.

One of the advantages we have going for us that I am not sure your record has reflected yet, although it may have before I came into the hearing room earlier, is the existence of many inventories such as the Nature Conservancy's Natural Heritage Inventory program and related programs that the State fish and wildlife agencies have done and data available from remote-sensing data of many kinds.

But the Natural Heritage Inventory program at least identifies endangered plant and animal species, and that is a good point of departure.

I think if we were to proceed on a State-by-State basis, for example, through the Fish and Wildlife Cooperative Research Units and the universities State by State, as has been begun in Idaho and

Oregon, with the process called Habitat Gaps and Corridors Analysis, where they do what I just suggested—they use all this data, the satellite imagery, the natural heritage inventories and they identify which plant communities, which life forms are without protection—then you can earmark your land acquisition and your easement money for those particular threatened habitats and you have forestalled endangerment. You have prevented endangerment rather than let species come up to the point of being endangered.

Mr. SCHEUER. Thank you, Dr. Cutler.

Mr. Waller, would you care to answer that last question that I asked Dr. Cutler? Are we sufficiently specific in the legislation regarding what constitutes a significant loss of biological diversity?

Dr. WALLER. I think that is a thorny issue, but I think that your legislation is currently almost as specific as it can be.

What we need here is leadership. What we need here is the credible and independent judgment of review panels and scientists. I think your bill would help avoid court cases.

Mr. SCHEUER. That is certainly our intent.

Dr. WALLER. We have 91 out of 93 national forest plans currently being appealed, these final plans. Now a lot of those are based on biological diversity.

But if there was a feeling among the environmental and scientific community that reasonable and proper steps were being taken by the agency, I think a lot of those appeals would disappear.

Dr. CUTLER. There is another thing that might happen, too, Mr. Chairman, and that is that after a court test or two there would be a case law history of what constitutes adequate performance under this statute, and it would begin to clarify itself, just as under the National Environmental Policy Act the first few cases made it much more clear what the act intended as far as the court system was concerned.

Mr. SCHEUER. Well, that's true. And if it has to happen, it will happen.

But our view would be that we ought to try to our utmost to clarify the level of specificity that is required in this legislation and avoid court cases that will delay and delay and delay and delay and let this whole rush toward loss of biodiversity just destroy this marvelous natural heritage that we have.

The process is going on, and we have to stop it, and we can only stop it if we achieve consensus in which industry plays a significant and proper role. And we are very keen to work with them in a cooperative and open-minded fashion to achieve the degree of specificity that will liberate them from having to have to take access to the courts.

Dr. WALLER. Could I just propose——

Mr. SCHEUER. Very briefly because we must get on.

Dr. WALLER [continuing]. A systematic effort to review policy decisions within the agency. That is very simple. All it takes is a few scientists and a certain amount of time. A simple review process for agencies and perhaps for particular decisions on how effective they are in conserving diversity would go wonderfully far to improving the performance of our Government in this area.

Mr. SCHEUER. Well, thank you very much.

I thank this panel. I thank you for your patience. It is only a few minutes from 5:00, and you have waited here all afternoon. Your testimony was splendid. We look forward to working with you.

[Whereupon, at 4:52 p.m., the hearing was adjourned.]

APPENDIX

HOUSE OF REPRESENTATIVES
THE FIFTEENTH LEGISLATURE
STATE OF HAWAII
STATE CAPITOL
HONOLULU, HAWAII 96813

Speaker
DANIEL J. KIHANO
Vice Speaker
EMILIO S. ALCON
Majority Leader
TOM OKAMURA
Majority Floor Leader
PETER K. APO

DISTRICT REPRESENTATIVES
1st — JERRY L. CHANG
2nd — HARVEY S. TAJIRI
3rd — WAYNE METCALF
4th — DWIGHT Y. TAKAMINE
5th — VIRGINIA ISBELL
6th — MIKE O'KIEFFE
7th — MARK J. ANDREWS
8th — HERBERT J. HONDA
9th — JOSEPH M. SOUKI
10th — ROZ BAKER
11th — DANIEL J. KIHANO
12th — SAMUEL S. H. LEE
13th — ROBERT BUNDA
14th — JOSEPH P. LEONG
15th — REB BELLINGER
16th — TERRANCE W. H. TOM
17th — MARSHALL K. IGE
18th — WHITNEY T. ANDERSON
19th — ED BYBEE
20th — CAM CAVASSO
21st — DAVID STEGMAIER
22nd — FRED HIRAYAMA
23rd — BARBARA MARUMOTO
24th — FRED HEMMINGS, JR.††
25th — CALVIN K.Y. SAY
26th — LES IHARA, JR.
27th — BRIAN T. TANIGUCHI
28th — JAMES T. SHON
29th — DAVID M. HAGINO
30th — JOAN HAYES
31st — CAROL FUKUNAGA
32nd — MAZIE HIRONO
33rd — ROD TAM
34th — MIKE LIU†
35th — KENNETH T. HIRAKI
36th — DWIGHT L. YOSHIMURA
37th — DENNIS A. ARAKAKI
38th — EMILIO S. ALCON
39th — ROMY M. CACHOLA
40th — KAREN K. HORITA
41st — TOM OKAMURA
42nd — CLARICE Y. HASHIMOTO
43rd — DAVID Y. IGE
44th — ROLAND M. KOTANI
45th — JULIE DULDULAO
46th — PAUL T. OSHIRO
47th — ANNELLE C. AMARAL
48th — HENRY HAALILIO PETERS
49th — PETER K. APO
50th — EZRA R. KANOHO
51st — BERTHA C. KAWAKAMI

†Minority Leader
††Minority Floor Leader

May 19, 1989

The Honorable Jim Wright
Speaker of the United States
House of Representatives
H-204 Capitol Building
Washington, D.C. 20510

Dear Speaker Wright:

I transmit herewith a copy of House Resolution No.196, which was adopted by the House of Representatives of the Fifteenth Legislature of the State of Hawaii, Regular Session of 1989.

Very respectfully,

Gerald I. Miyoshi
Clerk, House of Representatives

HOUSE OF REPRESENTATIVES
FIFTEENTH LEGISLATURE, 1989
STATE OF HAWAII

H.R. NO. 196

HOUSE RESOLUTION

URGING THE UNITED STATES CONGRESS TO SUPPORT THE ESTABLISHMENT OF A NATIONAL POLICY FOR THE CONSERVATION OF BIOLOGICAL DIVERSITY.

WHEREAS, the Earth's biological diversity is being rapidly reduced at an alarming rate without precedent in human history, and this trend is expected to increase greatly in the near future; and

WHEREAS, although the most rapid losses of biological diversity are occurring outside of the United States, biological impoverishment remains a serious problem within this country; and

WHEREAS, biological diversity is not only valuable as a source of intellectual and scientific knowledge, recreation, and aesthetic pleasure, but its reduction may have serious consequences for human welfare as untapped resources for research and agricultural, medicinal, and industrial development are irretrievably lost; and

WHEREAS, reduced biological diversity will diminish the raw materials available for scientific and technical advancement, including the development of improved varieties of cultivated plants and domesticated animals; and

WHEREAS, nowhere in this nation is biological diversity so evident than in Hawaii where 90 per cent of all the different plant and animal species are not found elsewhere in the world, thereby ranking Hawaii as number one in the world for its tally of endemic species; and

WHEREAS, however, the problem is that many of these endemic species are also endangered; just in terms of Hawaii's endemic plant species alone, approximately 800 species are considered endangered today; and

WHEREAS, although scientific and academic expertise are available to study this unique environment, fewer than 10 per cent of Hawaii's plants and animals have been studied for useful pharmaceutical or other properties; and

WHEREAS, to begin the process of addressing this problem, the United States Congress is currently reviewing legislation that would establish a national policy for the conservation of biological diversity and mechanisms for carrying out the national policy and for coordinating related activities; and

WHEREAS, this proposed legislation could set an example for the rest of the world and begin to reverse the trend of wholesale destruction of unique organisms on this planet; now, therefore,

BE IT RESOLVED by the House of Representatives of the Fifteenth Legislature, State of Hawaii, Regular Session of 1989, that this body urges the United States Congress to support HR 4335 ("National Biological Diversity Conservation and Environmental Research Act")that proposes to establish a national policy for the conservation of biological diversity; and

BE IT FURTHER RESOLVED that given Hawaii's unique role as caretaker for such an inordinately large and fragile population of endemic plants and animals, the United States Congress is further urged to give serious consideration for the establishment of the National Center for Biological Diversity in this State or at least a Regional Center for Tropical Biology that could take advantage of Hawaii's unique climate; and

BE IT FURTHER RESOLVED that certified copies of this Resolution be transmitted to the President of the United States Senate, the Speaker of the United States House of Representatives, and to each member of Hawaii's Congressional delegation.

OFFERED BY: David M. Hagino

David Y. Ige

Dennis A. Arakaki

MAR 23 1989

James T. Shon

Hawaiian Natural History and Conservation Efforts

What's left is worth saving

F. G. Howarth, S. H. Sohmer, and W. D. Duckworth

Stories of the Hawaiian Archipelago have been told innumerable times, and one of the most proficient tellers was Mark Twain who said of the islands that they are "the loveliest fleet of islands that lies anchored in any ocean." There has been a recent revival of interest in the natural history of these islands since the appearance of the popular works of Carlquist (1970, 1974) and the reports from the long-running *Drosophila* Project and the International Biological Program (Mueller-Dombois et al. 1981). Several special issues of magazines and journals have been devoted to the biota of these islands (Barrett 1975, Dodge 1982, 1987, Simon and Sudgen 1987, Ternes and Simon 1982).

Today tales of Hawaiian natural history are best told by the scientists who have been working with the various pieces of the organic evolution puzzle unfolding in Hawaii, and every such tale is permeated with as much mystery, wonder, and marvel as is any of the stories created by the fertile mind of Twain. However, these marvelous tales may have unhappy endings, because factors that have the potential to destroy much of the native plant and animal life were set loose the moment the first human set foot on these islands. We must pay more attention to and give more support to both the scientists and nonscientists who are working to avert the deterioration of natural Hawaiian ecosystems.

Recent biological discoveries should reinforce the conviction that Hawaii's native biota deserves protection

The archipelago

The Hawaiian Archipelago is much older than are the eight main islands that constitute the major part of Hawaii today. Indeed, the Hawaiian Archipelago is probably more than 70 million years old, whereas the oldest of the main islands, Kauai, is approximately 5 million years old. The small low islands and atolls—stretching from Kauai to Midway Island (which is dated at approximately 26–28 million years old) and Kure Atoll—are also part of the Hawaiian chain. Atolls were once fringing reefs that surrounded islands, some of which were perhaps as large as Hawaii Island is today. North of Kure Atoll, the archipelago continues as the Emperor Seamounts, some of which were once high islands. The chain extends all the way to the Aleutian Trench, where it is being subducted, along with the sea floor on which it stands, under the Asian Tectonic Plate.

The island chain was built in assembly-line fashion. As the sea floor tectonic plate moved northwest across a hot spot of volcanic activity, currently located just southeast of the island of Hawaii, the islands were carried away from the source of their lava flows. Subsidence and erosion began rapidly to wear away and diminish the size of each island in turn (Macdonald et al. 1983). Potassium/argon dates show that the Waianae Mountains on the islands of Oahu are approximately 3.7 million years old and that the Koolau Mountains, which form a spectacular background to the city of Honolulu on the same island, are approximately 2.6 million years old.

The Maui complex of islands is the next youngest, and the ages range from nearly 2 million years for Molokai to 800,000 years for Haleakala. The youngest and largest island is Hawaii, which was built by five volcanoes, and is commonly called the Big Island. The oldest dated lavas are only about 420,000 years old and are from the Kohala Mountains. Mauna Kea, which is 4205 meters high, is only about 380,000 years old. Kilauea is currently active and within the last year added even more territory to the southeastern part of the island. The formation of the island chain presents a remarkable scenario, especially when one adds the development of the biota.

The present-day main Hawaiian Islands are about 4000 km from the nearest continent and about 3200 km from the nearest high-island group of

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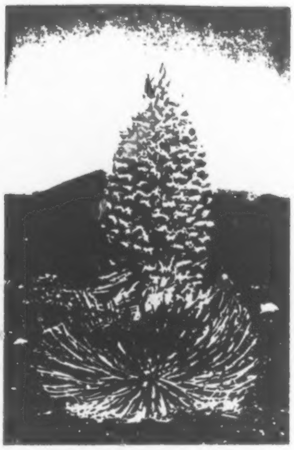

Figure 1. The silversword *(Argyroxiphium)* on Haleakala is one of the many native plants unique to Hawaii. Photo: G. Carr.

any size. They are the largest and most isolated group of oceanic islands on the earth. Before people arrived, any propagule would have had to travel that great distance on its own. But if it successfully colonized the new location, it would have had nearly unlimited opportunity to adapt to the various environments available.

Organisms did radiate into those environments, eventually producing a plethora of forms. Many of the presently known native Hawaiian flowering plants (Figure 1) are the result of spectacular speciation: over 22% of the genera have at least 6 (up to more than 50) native species.

Organisms occurring in a given area, such as the Hawaiian Islands, without the aid of human dispersal are said to be native. Organisms that are native and found nowhere else are called endemic.

Plants and animals have to be mobile and adaptable to survive and prosper in an oceanic setting like Hawaii. They have to be able to leave sinking, eroding islands and reach the newer islands continuously arising in the southeast. Probably few native species live on the same Hawaiian island that their ancestors originally colonized. The founders of the large genera are likely to have arrived before the present-day main islands began to form.

Not all types of organisms are represented, however, on the Hawaiian Archipelago. There are, for example, no native gymnosperms. A host of plant families are also missing. In addition, there are no reptiles, and bats are the only native terrestrial mammals. Relatively few bird families and only two butterflies are native to the islands. Approximately half the insect orders, and only 15% of insect families, are represented in the native terrestrial fauna (Mueller-Dombois et al. 1981, Zimmerman 1948).

The early colonists that were successful, however, evolved to exploit many ecological roles and give Hawaii a remarkable biotic diversity. Birds (Figures 2 and 3), snails, insects, spiders, and a few other invertebrate groups are the major groups represented in the native fauna, and some of the world's premier examples of adaptive radiation are found in Hawaii. Approximately 270 original colonists are hypothesized to have given rise to the approximately 1000 species of Hawaiian flowering plants known today. However, the data for insects is even more impressive: only 300–[illegible]00 insect colonists evolved into an estimated total Hawaiian fauna of well over 10,000 species. The most extreme case is the remarkable Hawaiian Drosophilidae, comprising over 800 species, which evolved from only one or possibly two founders (Kaneshiro, page 258 this issue).

Each island was colonized by dispersal of elements of the terrestrial biota from the neighboring, usually older, islands, with rarer infusions of propagules from longer distances. Interisland dispersal was a relatively rare event within many groups, allowing divergence from ancestral forms, so that, for most groups, single island endemic species are the rule, with close relatives found on neighboring islands. Much of island speciation is envisioned as founder events (e.g., as described for *Drosophila* by Carson and Templeton 1984).

Figure 2. How many generations to come? A frigatebird and its young on Midway island. Photo © 1988 R. J. Shallenberger.

Laboratory for evolutionary ecology

This isolation, together with the increasing ages of the islands and great habitat diversity (Figure 4) within each island, makes the Hawaiian Islands an ideal laboratory for research on evolutionary ecology. Each island can be viewed as a minicontinent, because communities and ecosystems on each island developed independently from across-water colonists. Interisland comparisons on community structure, niche breadth, resource partitioning, and species packing allow one to estimate the role of time in evolutionary and ecological processes, as well as to recognize unifying principles.

The nemobiine cricket genus *Caconemobius* represents a microcosm of these evolutionary phenomena (Howarth 1987). One recently discovered species, which inhabits rocky seacoasts on all the main Hawaiian Islands, is wingless, lives amongst boulders in the wave splash zone, and feeds on the flotsam stranded on the shore. Being halophilic, it appears to be able to survive interisland voyages on the open sea. On at least four islands, inland fresh water species, all of which also exploit only wet rock habitats, have evolved. On Kauai an undescribed species lives on wet cliff faces, as perhaps does the poorly known *Caconemobius schauinslandi* on Molokai. On both Maui and Hawaii Islands, at least two blind cave species each have evolved. In addition, on Hawaii a remarkable surface species, *Caconemobius fori,* evolved that exploits wind-borne debris only on the youngest unvegetated lava flows on Kilauea Volcano (Howarth 1979). The cave *Caconemobius* evolved independently on Maui and Hawaii, yet the degree of convergence is surprising (Howarth 1987).

In higher plants, there are many parallels to this radiation. The beach scaevola, *Scaevola sericea,* for example, is believed to have given rise to species dwelling in the mountain forests (Gillett 1966), and Carr (1987) postulated that the native tarweeds (Madiinae) and beggar's ticks *(Bidens)* have radiated both morphologically and physiologically as apparent adaptive shifts to exploit novel habitats.

Conventional wisdom has assumed that such young isolated islands, with their limited numbers of higher taxa, must have many ecological niches unexploited. However, recent discoveries in paleontology (Olson and James 1982) and ecology (Howarth 1987, Mueller-Dombois et al. 1981) led to questions about this assumption. Even on youthful Hawaii Island, both caves and barren lava flows support communities of species, many of which are obligately adapted to their specific high-stress habitat within the less than one million years of the island's existence.

Subterranean and aeolian (wind-supported) ecosystems have evolved on all suitable habitats within the islands. This observation indicates that such development is a general phenomenon. It also indicates that nutrients are continually lost from the more conventional ecosystems in sufficient amounts to support additional systems on otherwise barren substrates (Howarth 1987). Presumably such energy is also being exchanged between the conventional ecosystems. Such interdependence among ecosystems should be included in studies of nutrient cycling.

It is not unusual that five of the nine known species of *Caconemobius* are not yet named. In every native arthropod group critically studied using modern methods, especially field biological studies, new species are discovered. Often when a new species is discovered on one island, we successfully predict the existence of a related species in similar habitats on the other islands. Even within the relatively well-studied Drosophilidae, over 200 species remain undescribed in collections, and more species are continually being discovered. A modern invertebrate survey under the aegis of the B. P. Bishop Museum in Honolulu is being planned for the next decade to update knowledge of the arthropods and land snails in Hawaii.

Figure 3. The redfooted booby and its young. Photo © 1988 R. J. Shallenberger.

One of the more remarkable adaptive shifts discovered in recent years is that of the predatory moth larvae in the genus *Eupithecia* (Montgomery 1983). These inchworms (family Geometridae) are highly specialized ambush predators, which capture active

Figure 4. Hawaii provides diverse habitats. (Left) Akaka Falls on the island of Hawaii. (Right) Young lava flow on Mauna Loa supports an Ohia tree. Photos © 1988 R. J. Shallenberger.

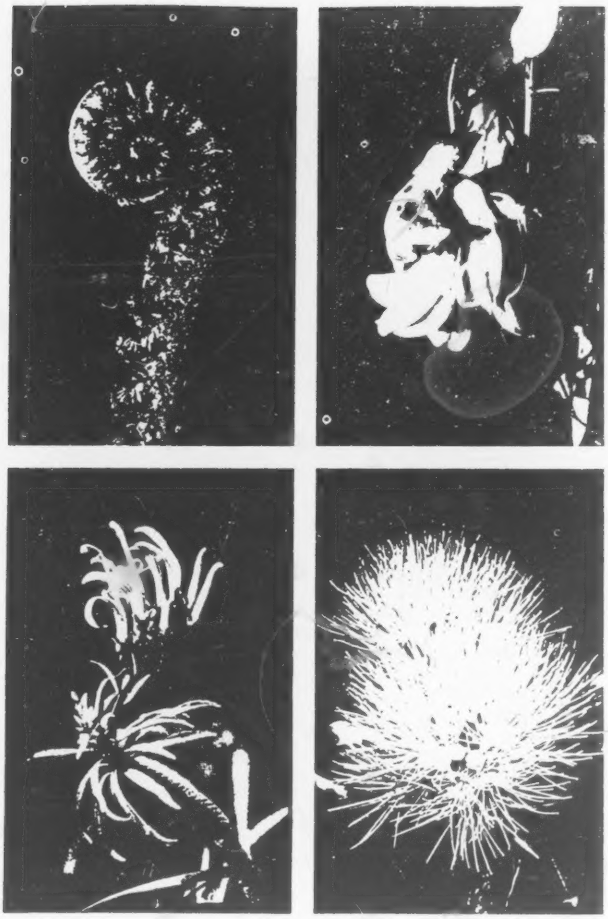

Figure 5. Native Hawaiian flora. (Top left) A *Sadleria* fiddlehead on Maui. (Top right) *Vicia*. (Bottom left) Kolii (*Trematolobelia*) on the Koalau summit. Photos © 1988 R. J. Shallenberger. (Bottom right) Ohia-lehua (*Metrosideros polymorpha*). Photo: R. Gustafson.

prey—insects, spiders, and other arthropods—rather than being phytophagous like their relatives and nearly all other Lepidoptera. More than a dozen pre~~datory species~~ are known to date, each of which is adapted to perch and wait in ambush on a specific substrate, such as leaf edges, fern fronds, twigs, mosses, or leaf litter. Each species is remarkably camouflaged, both morphologically and behaviorally, to its perch (Montgomery 1983). These predatory *Eupithecia* species are assumed to share a common ancestor with *Eupithecia monticolans*, the only phytophagous Hawaiian *Eupithecia* species. Its larvae feed on flower stamens of *Metrosideros polymorpha*, a protein-rich food. This diet can be considered a preadaptation to the food shift.

Major gaps in the natural history of Hawaiian birds also exist, and the surviving species provide remarkable systems for important research in evolutionary ecology (Conant, page 254 this issue; Freed et al. 1987; Scott et al., page 238 this issue). There have been many extinctions and Hawaiian forests cannot be considered pristine, but, in some montane rain forests, native bird densities are the highest recorded anywhere in the world (Scott et al. 1986).

The fight against extinctions

Hawaii has lost so much natural diversity since the arrival of humans (Kirch 1982, Olson and James 1982) that one might despair that nothing is left worth saving. Two-thirds of the bird species, including all the flightless species; over one-half of the endemic land snails; and untold numbers of insects have already been lost. About 30% of the remaining native flora (Figure 5) are endangered species candidates. Against these odds, does any native species have a chance to survive? The resilience displayed by the surviving native species provides an optimistic answer.

Recent biological discoveries, including new species and new concepts in evolution and ecology, discussed in this issue, should reinforce the conviction that the native Hawaiian biota deserves protective management. Recent research and protective management actions in national parks, nature conservancy reserves, and national wildlife refuges demonstrate that native species benefit from appropriate conservation programs and that conservation of the remaining native biota is possible (Gagné, page 264 this issue; Mueller-Dombois et al. 1981; Stone and Scott 1985).

In this issue, J. Michael Scott et al. (page 238) bring us up-to-date on the status and conservation priorities concerning Hawaii's native birds. Sheila Conant (page 254) suggests caution in viewing translocation of endangered species as a solution for preventing their extinction. Kenneth Kaneshiro (page 258) reports on behavioral research on the Hawaiian *Drosophila* in the quest to decipher the genetic basis for the speciation process. Wayne C. Gagné (page 264) summarizes the conservation priorities and the history of conservation efforts in Hawaiian ecosystems. Lloyd Loope et al. (page 272) compare the conservation biology of Hawaii and the Galapagos and conclude that managing nature reserves in isolated islands may prove to be no more difficult than doing so in many fragmented continental reserves.

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TESTIMONY ON THE NATIONAL BIOLOGICAL DIVERSITY, CONSERVATION AND ENVIRONMENTAL RESEARCH ACT

HR 1268

House Science, Space and Technology Committee

Natural Resources, Agriculture

Research and Environment Subcommittee

Prepared by

Dr. Susan Lieberman

Associate Director

Wildlife and Environment

THE HUMANE SOCIETY OF THE UNITED STATES

May 17, 1989

On behalf of The Humane Society of the United States (HSUS) and our more than 930,000 constituents, I would like to thank the members of the House Science, Space and Technology Committee, Natural Resources, Agriculture Research and Environment Subcommittee for the opportunity to submit testimony today. I would also like to specifically thank Congressman Scheuer for his efforts on behalf of the preservation and protection of the world's biodiversity.

The HSUS supports HR 1268, the National Biological Diversity, Conservation and Environmental Research Act. We are strongly committed to protecting and restoring endangered species, and we believe this legislation helps achieve that goal.

The current pace of destruction of the world's tropical forests is threatening entire ecosystems with extinction, with potentially tragic consequences for the whole globe. At the present rate of forest destruction and degradation, by the turn of the century all of the earth's lowland tropical rainforests, our richest treasure houses of animals and plants, will be gone.

Hopefully, legislative initiatives like HR 1268 on behalf of the world's biodiversity will help prevent this disaster.

We particularly support the section of the bill that amends the National Environmental Policy Act (NEPA) to require explicit consideration of biological diversity in Environmental Impact Statements. We suggest that overseas activities of government agencies (i.e. the Agency for International Development (AID) and the National Institutes of Health (NIH)), companies funded by the federal government, and multilateral development banks with U.S funding, all be required to prepare Environmental Impact Statements on their activities, and address biodiversity implications, since they all have an effect on the success or failure to protect the environment.

We would like to take this opportunity to address one often-overlooked aspect of the preservation of the world's biodiversity: the commercial importation and sale of wild-caught birds. We urge you to amend the bill to include a ban on the commercial importation of wild-caught birds into the United States. This would significantly aid the biodiversity and conservation efforts of other nations, provide a better mechanism to control smuggling into the United States, and allow the populations of many species of wild birds to recover from the disastrous effects of exploitation by the pet trade. Such a prohibition will also prevent the deaths and suffering of hundreds of thousands of wild birds.

An amendment will of course in no way restrict the sale of captive bred birds. Rather, it will encourage the development of a captive breeding industry by requiring the market to rely on domestically bred birds. We recommend that no restrictions, other than those that already exist under the U.S. Department of Agriculture (USDA), be placed on accredited zoological or bona fide educational institutions.

Many species of parrots, macaws, cockatoos and toucans, like all birds, are important components of their ecosystems in the forests of South America, Central America, Africa, and Asia. Unfortunately for both individual birds and their species as a-whole, an industry has developed to exploit these birds -- which are often of unknown health status -- for their market value. These birds are captured and exported for sale in the U.S.A. and Western Europe, and Japan. Many nations, such as Brazil and Mexico, have banned the export of their wildlife. But as long as we continue to offer a market for wild birds, enforcement of those bans is virtually impossible. Federal law prohibits the capture of our own native wild birds for the pet market. We should provide the same level of protection to the wildlife heritage of other nations.

The number of birds imported legally into the United States has increased from less than 300,000 in 1976 to more than 900,000 in 1984, according to the United States Department of Agriculture (USDA). In the latest five year period for which we have complete statistics from USDA, 193,733 birds died while in transit to the United States, and 584,364 died while in quarantine or were refused entry because of the virulent Newcastle Disease and were either destroyed or re-exported.

According to the Royal Society for the Protection of Birds and the International Council for Bird Preservation, at least seven and one half million birds are taken from the wild every year for the international trade. The Environmental Investigation Agency, based in London, puts that figure at between 10 and 20 million per year. These birds are wild-caught in Asia, Africa, and Latin America, and are shipped to the United States, Europe and Japan. In descending order, the largest exporters of wild birds to the U.S. are Senegal, Tanzania, and Argentina.

The methods used to capture and transport wild birds are cruel and inhumane, and cause suffering and death to hundreds of thousands, indeed millions, of birds every year. It is estimated that for every wild bird that reaches a pet store alive, from 5 to 10 have died along the way, depending on the species. Yet, we can do something about this without precluding people from owning birds for pets. More than 30% of all species popular as cage birds can be bred in captivity. Therefore, there is no justification whatsoever for continuing to deplete the world's wildlife diversity by capturing wild birds for the pet market.

Last year, after an eight year delay, the Department of the Interior published Humane and Healthful Transport Regulations, for the importation of all live wild mammals and birds. Under pressure from the pet industry lobbying organization, and bird importers, these regulations were illegally withdrawn. However The HSUS, along with several other animal protection organizations, won a court case to have the regulations reinstated.

While these regulations are now in effect, enforcement efforts by the Fish and Wildlife Service have been weak and ineffectual. The flood of illegal imports and limited resources for inspection make it increasingly apparent that the best, and perhaps only way to guarantee that these exotic birds will not die in the cargo holds of airplanes or at the hands of trappers is to prohibit completely their sale and importation.

Many individual wild birds that are imported are members of threatened or endangered species. The wild bird trade has wreaked havoc on bird populations.

All parrots and their relatives are listed on Appendix II of the Convention on International Trade in Endangered Species

(CITES), thereby monitoring their trade. Many species of parrots and macaws are now listed on Appendix I (endangered due to trade), and are virtually extinct in the wild, due to the pet market. At the 1987 CITES Conference, the Scarlet Macaw, once a common bird in Central America, was placed as Appendix I - endangered due to trade. The Moluccan cockatoo, once very abundant, is a candidate for listing Appendix I at this year's CITES Conference. Populations of these and numerous other Psittacine (parrots and their relatives) species have been depleted due to capture for pets. Habitat loss is not a factor in the depletion of many Psittacine species -- large tracts of prime tropical forest habitat have been emptied of macaws, for example, to supply the pet market. It is the human factor which is killing off bird populations.

CITES, to which the U.S. and more than 95 other nations are signatories, adopted the following resolution in 1976:

> "Recognizing firstly that many species of animals which are popular in the pet trade are becoming rare or even endangered due both to overexploitation and diminishing habitats and secondly that mortality in the trade and captivity is high, this Conference urges that contracting countries endeavour to restrict gradually the collection of wild animals for the pet trade and to encourage the breeding of animals for this purpose with the objective of eventually limiting the keeping of pets to those species which can be bred in captivity".

The International Council for Bird Preservation (ICBP), to which The HSUS belongs, has stated,

> "While there are a number of reasons for the decline or disappearance of individual species, one of the most persistent and pernicious is the taking of birds in the wild for the cagebird trade. A number of species, particularly parrots, are either extinct or severely endangered due to the almost unrestricted market for them in United States."

There is no scientific evidence that any parrot populations can sustain any level of exploitation whatsoever by the pet trade. In short, the commercial trade in wild-caught birds for the pet market and sustainable development are mutually exclusive. As subcommittee members know first hand from the letters they receive from their constituents, the American people strongly support protecting rare and endangered species. In this spirit, and in the pursuit of international conservation, we urge you to amend the Biodiversity Bill, HR 1268, to include a ban on the commercial importation of wild-caught birds. Without it, the erosion of biodiversity can never be stopped completely.

David

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June 20, 1989

Honorable James Scheuer, Chairman
House Natural Resources Subcommittee
U.S. House of Representatives
Washington, D.C. 20515

Dear Congressman Scheuer:

For your information I am enclosing a copy of a resolution past by an overwhelming majority of the membership of the American Society of Zoologists. The resolution deals with the Conservation of Biological Diversity.

The American Society of Zoologists has over 4000 members and will celebrate its Centennial this year during the annual meetings in Boston, December 27-31.

Thank you for your interest and support.

Sincerely,

Karel F. Liem, President
American Society of Zoologists

Resolution approved by the American Society of Zoologists, 1988

CONSERVATION OF BIOLOGICAL DIVERSITY

WHEREAS, biological diversity provides all of the food and much of the shelter, clothing, and medicine essential for human welfare, and is the basis for ecological processes, scientific inquiry and aesthetic pleasure and

WHEREAS, biological diversity is currently being reduced at rapidly increasing rates that are unprecedented in human history and that rival those of the mass extinction events of geological time; and

WHEREAS, the deterioration of the biological diversity of the planet will greatly reduce the future options for civilization and have serious consequences for human and environmental well-being; and

WHEREAS, the loss of biological diversity is largely irreversible; and

WHEREAS, the loss of biological diversity is largely an inadvertant and unintended consequence of human activity; and

WHEREAS, our scientific and technical knowledge and social institutions are presently insufficient to prevent this loss;

THEREFORE BE IT RESOLVED, that the AMERICAN SOCIETY OF ZOOLOGISTS requests that the Congress of the United States approve legislation to establish the conservation of biological diversity as a national policy and a national priority, require biological diversity to be of paramount importance in environmental planning and international development, to establish and implement a federal strategy for conservation of biological diversity, and to support education and basic and applied research in organismal biology, ecology, and related sciences necessary for biological conservation.

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ROBERT L. CURRY
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July 7, 1989

VIA FEDERAL EXPRESS

Mr. David Blockstein
Subcommittee on Natural Resources,
  Agriculture, Research and Environment
H2-388
Washington, D.C. 20515

RE: NEPA - Biological Diversity

Dear Mr. Blockstein:

As we discussed on the telephone on Thursday, July 6, I feel strongly that the broad terminology in Section 102 of NEPA found in such terms as "environmental impact" and "any adverse environmental effects" (emphasis added) definitely includes the environmental consequences contemplated within the notion of "loss of biological diversity". Further, I think the CEQ Regulations at 40 C.F.R. §1508.1 et seq. acknowledge in a number of ways the breadth of the idea of environmental consequences which are intended to be addressed by the Act. For example, the definition of "effects" at 40 C.F.R. §1508.8, which includes "indirect effects", includes impacts on "... natural systems, including ecosystems." "Effects" includes impacts that are "... ecological (such as the effects on natural resources and on the components, structures and functioning of affected ecosystems ..." (emphasis added). And I would argue that a reduction of biological diversity is definitely a "cumulative impact" that must be accounted for under 40 C.F.R. §1508.7.

These issues are presently being raised be conservationists in Wisconsin, not only in the Chequamegon and Nicolet Forest Plan Appeals, but also in a number of individual timber sale appeals on the Nicolet National Forest. In implementing its Plan, the

Nicolet has acknowledged that it must comply with NEPA at the site-specific level when authorizing individual timber sales. We argue that in planning specific projects pursuant to the broad Forest Plan direction, the assessment of the cumulative impacts on the structure and function of the affected ecosystems must include some disclosure of the cumulative effect on biological diversity. Enclosed is our Statement of Reasons and Appendix in the Crooked Lake Opportunity Area appeal filed March 15, 1989. The issues of NEPA compliance are dealt with throughout the brief, but the issues you and I have discussed are specifically dealt with beginning at page 37.

In light of this, I would hope that in any efforts to "clarify" NEPA, it would be clearly stated in Committee reports that any and all environmental consequences are already within the scope of NEPA and the additional language sought to be added is merely to highlight and emphasize certain requirements which, because of developing scientific knowledge, may not traditionally have been included in treatments of environmental consequences. I would hope it would be clearly stated that concerns about biological diversity are certainly cumulative effects already addressed by NEPA and the CEQ regulations. My concern is that if your efforts to amend NEPA and to enact the diversity bill are unsuccessful, this effort could constitute unfavorable legislative history, with a negative implication that Congress perceived NEPA not to already include concerns of biological diversity. A defeat of the bill could be said to indicate Congress chose affirmatively not to have such considerations included in the scope of NEPA. Any language in the committee report to preclude any such negative implications would be helpful.

Such language would also bar any argument that actions brought under NEPA prior to a successful amendment (e.g. our cases in Wisconsin) are unable to argue non-compliance with NEPA because of a lack of consideration of biological diversity.

Perhaps in light of these concerns, amendments to NEPA pose risks that make that aspect of your efforts less attractive. Perhaps it is enough to create the new separate legislation. I would doubt that courts will find NEPA's current broad language does not reach impacts on biological diversity.

Mr. David Blockstein
July 7, 1989
Page 3

Thank you for your consideration of these remarks. Please call or write if you have any questions.

Very truly yours,

BOARDMAN, SUHR, CURRY & FIELD
By

Walter Kuhlmann

WK/cab
Enclosure

American Association of Zoological Parks and Aquariums
EXECUTIVE OFFICE AT OGLEBAY PARK, WHEELING, WV 26003-1698 (304) 242-2160

A•A•Z•P•A 1924

July 24, 1989

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The Honorable James H. Scheuer
Chairman
Subcommittee on Natural Resources, Agriculture
Research and the Environment
House Annex #2, Room 388
Washington, D.C. 20515

Dear Chairman Scheuer:

The American Association of Zoological Parks and Aquariums submits these comments on H.R. 1268, the National Biological Diversity Conservation and Environmental Research Act of 1989. AAZPA is very supportive of your efforts to implement legislation to maintain the diversity of life through planning and prevention based on the best scientific information and understanding available. We commend you and the Committee for taking the leadership role in expressing concern about loss of biological diversity and for proposing legislation to address those concerns.

The bill states that the function of the Interagency Working Committee on Biological Diversity is to prepare a coordinated Federal strategy for conservation of biological diversity. AAZPA believes this is more appropriately the role of the Scientific Advisory Committee which is comprised of scientists possessing particular expertise in the area of biological diversity. Under our proposed framework, the Interagency Working Committee would have the role of providing technical advice and counsel to the Scientific Advisory Committee to ensure that the responsibilities placed on Federal agencies are practical and can be implemented. Further, the Interagency Working Committee would be responsible to implement the strategy within the government. We do not believe the Interagency Working Committee should be dissolved two years after the date of the enactment of the Act. This Committee would need to continue to implement the strategy.

Finally, AAZPA believes that the language describing the 12 scientist members of the Scientific Advisory Committee should be more explicit. There needs to be a balance ensured on the Committee and a mechanism for avoiding the political in-fighting that can occur with a Presidentially appointed Committee. We urge that one of the scientists on the Committee be from a zoological institution with experience in linking in situ and ex situ conservation approaches.

AAZPA urges the Subcommittee to consider our suggested changes and pass H.R. 1268.

Sincerely,

AMERICAN ASSOCIATION OF
ZOOLOGICAL PARKS AND AQUARIUMS

Robt O. Wagner

Robert O. Wagner
Executive Director

Copy to: Board of Directors

Waste Management, Inc.
Government Affairs Department
1155 Connecticut Avenue, N.W. Suite 800
Washington, D.C 20036

May 15, 1989

The Hon. James H. Scheuer, Chairman
Subcommittee on Natural Resources,
Agriculture Research and Environment
U.S. House of Representatives
Washington, DC

Dear Mr. Scheuer:

We at Waste Management, Inc. have recently initiated an effort to ensure not only that our activities will cause no net loss of wetlands, but also that what we do will cause no net loss of biological diversity more broadly defined. I am unaware of any other corporation that has taken such a position. Attached is a copy of a letter on this matter from WMI's Chairman to the President of the Conservation Foundation.

Knowing of your upcoming hearing on biological diversity, I am taking this opportunity to apprise you of our initiative and to request respectfully that you include this letter and the attachment in the record of your hearing on this subject.

Sincerely,

William Y. Brown
Director of Environmental Affairs
Waste Management, Inc.

Attachment

Waste Management, Inc.
3003 Butterfield Road
Oak Brook, Illinois 60521
312/572-8800
Telex: 253094 · TWX: 910-651-0029

Dean L. Buntrock
Chairman of the Board &
Chief Executive Officer

March 22, 1989

Ms. Kathryn Fuller
President
The Conservation Foundation
1250 Twenty-fourth Street, N.W.
Washington, D.C. 20037

Dear Ms. Fuller:

I am writing in response to a letter that Bill Reilly sent to me concerning the work of the National Wetlands Policy Forum.

I applaud the work of the Forum and support the policy of no net loss of wetlands. We share your concern over the dramatic loss of wetlands that our country has suffered and the need for renewed efforts to curb that loss.

Waste Management, Inc. has taken several steps to do its part in this effort. In our philanthropy, we have made a priority of conserving wetlands, as well as other key elements of biological diversity. In 1987 and 1988, we made grants supporting wetland conservation to the National Wildlife Federation, the Nature Conservancy and the IUCN, in addition to grants to other environmental organizations for conservation of biological diversity more generally. In 1988, for example, we provided the Nature Conservancy with a grant of $70,000 to provide for acquisition of a waterbird breeding rookery on Lake Renwick in Illinois. We intend to continue this focus in the future.

Internally, we are evaluating potential options for donation of properties for conservation. In addition, we are sensitive to the need for our own activities to comply with a policy of no net loss of wetlands. We routinely evaluate the potential effect of our operations on wetlands, and endeavor to avoid or to minimize any adverse effect. I am now taking an additional step and initiating an effort within Waste Management to develop a system for evaluating our activities against a policy of "no net loss" of wetlands.

WMI's internal evaluation of the no net loss policy will also consider potential extension of such a policy to other important habitats contributing to biological diversity. As you know, there are ecosystems besides wetlands warranting conservation, such as the tall grass prairies in the Midwest and forests with old growth in the Pacific Northwest. In Northern California, for example, WMI developed and is implementing a conservation plan for the Bay Checkerspot Butterfly which lives in upland habitat near the company's Kirby Canyon Landfill. Among other things, WMI has set aside more than a hundred acres for the butterfly and has established a $500,000 trust fund to provide for conservation of the species. Enclosed is a reprint of a Wall Street Journal article on the matter.

Such a "no net loss" policy should be balanced. For example, it should give credit for conservation of areas adjacent to those that are developed and it should not count as loss of diversity a temporary, localized effect whose correction is committed to from the beginning. One thing that we are looking at in this regard is conservation of wetlands and other ecosystems in the planning for opening, operation, closure and post-closure care of a landfill.

Provided that such balance is accounted for, it may make good sense and good conservation to extend the "no net loss" concept beyond wetland ecosystems, and I encourage the Conservation Foundation and other non-profit environmental organizations to consider such a broader concept.

I know that you also appreciate that our Washington Office has worked actively in support of legislation promoting conservation of biological diversity. Individuals in that office also are deeply involved in the work of non-profit organizations concerned with wetlands. For example, Jim Range serves as Chairman of the National Fish and Wildlife Foundation, and Bill Brown is Chairman of the Center for Marine Conservation. WMI encourages and supports such involvement.

I am pleased to see the Foundation's continuing interest in this area and hope that this letter is helpful. Congratulations on your recent appointment as President of the Conservation Foundation and the World Wildlife Fund-U.S. We look forward to working with you regularly on this and other environmental matters. When your schedule permits, I would be delighted if you would be our guest for lunch in Oak Brook.

Very truly yours,

Encl.

cc: William K. Reilly
Gail Bingham
Walt Barber
Bill Brown ✓
Don Wallgren

Reprinted from THE WALL STREET JOURNAL.

THURSDAY, APRIL 23, 1987

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One Company Treats A Butterfly Gruffly, Another Is Friendlier

* * *

Endangered-Species Plan Has Defense Contractor Riled; Waste Firm Makes a Deal

By Ken Wells
Staff Reporter of The Wall Street Journal

SAN JOSE, Calif.—United Technologies Corp., the giant defense contractor, peered out over the rolling green hills near here and spotted the enemy.

It was a butterfly.

The company declared war. It implied that the butterfly was a menace to national defense because it might interfere with the company's building and testing of motors for missiles and rockets at its 5,200-acre facility here.

Waste Management Inc., the big waste-disposal concern, gazed across its own green hills in adjacent Kirby Canyon and saw, in the same butterfly, an opportunity. The company set up a butterfly preserve and made the butterfly the mascot of its 800-acre local landfill. The butterfly also stars in a slick television commercial aimed at showing that Waste Management, whose garbage-disposal plans haven't always inspired public confidence, isn't an environmental lout.

Two Points of View

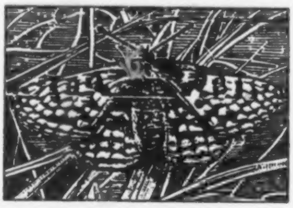
Herein lies a tale of how two corporations, faced with the same public-policy question, can see it a mite differently. The issue is whether *Euphydryas editha bayensis*, commonly known as the Bay checkerspot, belongs on the federal endangered-species list. A decision by the Interior Department is due this summer, and most people who know anything about the subject think the checkerspot will make the list.

Why should United Technologies or Waste Management care? Well, three years ago, federal officials proposed to designate their land here "critical habitat" for the checkerspot, which meant that if the butterfly finally made the endangered list, their use of the land might be restricted.

United Technologies has waged an aggressive three-year campaign to derail the listing, largely by contending that the butterfly isn't so rare. The Connecticut-based contractor hired a biologist and sent him on a butterfly-sighting expedition by helicopter. He said he found the checkerspot population far larger than had been supposed.

The company has also pressed its national-defense argument—and rolled out some big guns in the process: The undersecretaries of the Navy and Air Force told the Interior Department that the listing of the butterfly could slow the delivery of Minuteman and Tomahawk missile propulsion systems.

United Technologies has also retained Pillsbury, Madison & Sutro, a prestigious San Francisco law firm, to raise technical challenges to the listing. And not long ago the defense contractor further angered butterfly supporters by digging a water pipeline through a butterfly patch. The company says the pipeline didn't disturb more than 1% of the patch, and it uses the project as an example of the kind of thing it won't be able to do if the butterfly is listed.



"What's stupid about this is that United Technologies has spent far more money fighting this listing than it would have ever cost them to accommodate the butterfly," says Dennis Murphy, a Stanford University associate professor of biology who is the butterfly's chief sponsor. "Now you understand why there are $600 toilet seats," he says.

Besides, Mr. Murphy says, the company is still fighting as though its use of the entire 5,200 acres might be restricted, whereas the government now has determined that the checkerspots on United Technologies property largely inhabit only buffer lands that distance the company's rocket work from prying eyes.

The company, for its part, says its defense work at the site is top secret, so Mr. Murphy can't possibly know how the butterfly's listing might interfere with company projects or how much a butterfly accommodation program would cost.

The diminutive checkerspots seem harmless enough. Each March and April, millions of them flutter from cocoons in a billowing dance of yellow, black and orange. But sheer numbers can be misleading. The butterfly's world-wide permanent range, experts say, is largely confined to a handful of native grass and wildflower plots on the rocky slopes of the hills here. And without a plan to preserve and nurture that habitat, the Bay checkerspot's days are numbered, says Paul Ehrlich, a Stanford professor who has monitored the butterfly's dwindling population for 28 years.

The checkerspot is also involved in long-term behavioral studies—carried out by Mr. Ehrlich under National Science Foundation grants—that hold promise of widening science's ability to control insect pests without poisons.

Protection Sought in 1980

For those reasons, Mr. Murphy sponsored the butterfly for protected status in 1980. Four years later, the U.S. Fish and Wildlife Service, which administers the Endangered Species Act, recommended to its bosses at the Interior Department that the butterfly be put on the endangered-species list. If that happens, landowners would be barred from proceeding with development on checkerspot habitats until they assured federal authorities, in formal plans, that the species would be protected.

At the time, Waste Management was still negotiating approval for its landfill, a $15 million garbage-disposal site for San Jose that is expected to generate hundreds of millions of dollars in revenue for the company over a 50-year period. So initially, Waste Management greeted the butterfly's emergence as an issue with the same glee it might muster upon finding Godzilla crawling out of a dumpster.

But a company official, who had dealt with endangered species before, suggested summoning Mr. Murphy, who came over to take a look. What he found was that the checkerspots on the Waste Management land thrived largely on a 250-acre plot that sat on an upper slope well out of the reach of the prime garbage-disposal area. Wheels whirred and telephones rang in the upper echelons of Waste Management's Oak Brook, Ill., corporate offices.

Soon Mr. Murphy had arranged a deal. Only the 250 acres would be designated critical habitat. Waste Management agreed to set aside that plot as a permanent Bay checkerspot preserve and to spend more than $1 million over the next 10 years in research and preservation efforts, including eventual reseeding of landfill slopes to make them habitable to new colonies of checkerspots outside the 250 acres. In exchange, Mr. Murphy vouched that the plan offered the butterfly adequate protection, a move that silenced critics who had vowed to stop the landfill.

'The Way to Go'

"It could have been a serious problem for us," says Phillip Rooney, Waste Management's president. Fighting the listing "was an alternative," he says, "but we chose preservation as the way to go."

These days, huge "butterfly crossing"

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STATEMENT FOR THE RECORD

OF

THE WISCONSIN PAPER COUNCIL

ON

H.R. 1268
THE NATIONAL BIOLOGICAL DIVERSITY CONSERVATION
AND ENVIRONMENTAL RESEARCH ACT

BEFORE THE

SUBCOMMITTEE ON NATURAL RESOURCES,
AGRICULTURE RESEARCH AND ENVIRONMENT

OF THE

COMMITTEE ON SCIENCE, SPACE AND TECHNOLOGY

Introduction

The Wisconsin Paper Council was unable to appear at the public hearing on H.R. 1268 conducted May 17, 1989, in Washington, D.C.

We sincerely appreciate the opportunity to submit our written comments for the record.

The Wisconsin Paper Council, based in Neenah, Wisconsin, is the trade association representing the pulp, paper and allied industry in the state.

Background

Wisconsin's paper industry is very interested in bio-diversity issues on a state, regional, national and international level.

Wisconsin is the nation's leading paper manufacturing state, producing over 4.2 million tons of paper products, and nearly 5.0 million tons of paper and paperboard products annually.

Approximately 75 percent of this production is manufactured directly from wood fiber; most of the remaining 25 percent is manufactured from recycled wood fiber.

Healthy, productive forests are, figuratively and literally, the "lifeblood" of the pulp, paper and allied industries.

Wisconsin's paper industry is recognized as a steward of forest resources; for example:

* While the amount of timber in Wisconsin continues to expand annually as growth exceeds harvests, and while the paper industry owns less than 8.0 percent of Wisconsin's 14.7 million acres of productive forestland, papermakers engage in aggressive reforestation programs, planting more than 8.25 million seedlings annually.

* The industry supports public and private research targeting methods to develop, improve and protect trees and the forest environment today and in future years.

* Papermakers provide advice and assistance to private, non-industrial forest landowners through the American Tree Farm program and company-specific programs.

- The Wisconsin Paper Council supported "The Wisconsin Wilderness Act of 1984" which added over 24,000 acres of forestland to permanent, non-managed RARE II "wilderness" status.
- The Wisconsin Paper Council has been cooperatively involved in the development of all environmental protection laws, except those addressing mining, enacted in the state in the past 15-20 years, including various forest practices initiatives.

In summary, the paper industry in Wisconsin is active in the development of responsible forestry public policy and "on the ground" forest management programs.

However, we do not support H.R. 1268. There are a number of reasons for our position.

A Uniform Definition of Bio-Diversity Should Be Developed Before New Legislation is Enacted

Bio-diversity is a rapidly developing field which presently lacks a uniform definition.

Many of the existing definitions have been developed in piecemeal fashion, responding to single-focus or unrelated research and regulatory initiatives.

Foresters, ecologists, forest biologists, botanists and related professionals from applied and theoretical scientific disciplines are, as yet, unable to reach consensus on whether there may be a bio-diversity problem in the United States; what may be the parameters of any concerns; and if concerns are identified, what solutions will be most effective, efficient and cost-beneficial.

Until these issues are adequately addressed, enactment of H.R. 1268 is premature. In fact, numerous laws exist to address any current problems.

Over Two Dozens Laws Exist to Address Bio-Diversity

A 1987 report by the Office of Technology Assessment, titled "Technologies to Maintain Biological Diversity," identified 28 federal laws relating to biological diversity.

Enactment of H.R. 1268 will neither enhance, nor further bio-diversity conservation efforts in a nation which already has such a range of laws.

Major Efforts to Provide a Consensus and Direction to Bio-Diversity Conservation Efforts Are Occurring Nationally, Regionally and In the States

Not only does the United States have a wealth of bio-diversity laws, but a wide range of interests -- the forest products industry, environmental groups, academia, state and federal regulatory agencies -- are actively involved in developing a consensus on bio-diversity and a research agenda to enhance bio-diversity conservation.

These efforts are national, regional and state-based in focus.

Bio-Diversity Activity in Wisconsin

For example, discussion of bio-diversity is a key subject as industry and wilderness advocacy groups begin facilitated negotiations of appeals of U.S. Forest Service management plans for the Nicolet National Forest, located in north central Wisconsin, and the Chequamegon National Forest, located in northwest Wisconsin.

Forest products industry representatives who will participate in the efforts include members of the American Pulpwood Association, the Lake States Lumber Association, the Lake States Women in Timber, the Michigan-Wisconsin Timber Producers Association, the Western Forest Industries Association, and the Wisconsin Paper Council. These state-level discussions will begin this summer.

Bio-Diversity Research in Region 9, USFS

Region 9 of the U.S. Forest Service, comprising most of the northeastern portion of the United States, has initiated a Lake States Coordinating Committee on Bio-Diversity. The committee will focus on key bio-diversity issues, including a consensus definition and an assessment of bio-diversity conservation needs.

The broad-based committee includes representatives from the Minnesota, Wisconsin and Michigan natural resources agencies, local government, conservation organizations (The Audubon Society, The Nature Conservancy), forest recreation groups, academia (Michigan State University, University of Wisconsin), federal agencies (Fish & Wildlife Service, Forest Service, Soil Conservation Service) and the forest and paper products industry (Rajala Lumber Company, Nekoosa Papers). This multistate effort is in progress.

The Keystone Center's "National Dialogue"

A "national dialogue" on bio-diversity -- coordinated by The Keystone Center of Colorado -- began this spring. The initiative, involving 45 individuals with different perspectives, targets development of a report outlining areas of consensus -- with associated recommendations -- as well as clarification of areas of disagreement. The Keystone Center report is due in 18 months.

Conclusion and Recommendations

There is no consensus on what is meant by "bio-diversity," whether there is any bio-diversity problem in the United States, nor what policies or programs might be beneficial to further enhance bio-diversity conservation.

In addition, numerous federal laws already exist to address bio-diversity needs.

Comprehensive efforts are in-progress -- on state, regional and national levels -- to develop consensus and recommendations on bio-diversity topics. Of particular note is The Keystone Center's "national dialogue."

Consequently, the Wisconsin Paper Council urges that enactment of additional biological diversity conservation legislation be postponed until The Keystone Center's report is issued and assessed.

Respectfully submitted,

Earl Gustafson

Earl Gustafson
Energy/Projects Manager
Wisconsin Paper Council

lr

May 24, 1989

United States Department of Agriculture
Forest Service
Washington Office
12th & Independence SW
P.O. Box 96090
Washington, D.C. 20090-6090

Reply To: 1510

Date: JUL 17 1989

Honorable James H. Scheuer
Chairman, Subcommittee on Natural Resources,
Agriculture Research and Environment
Committee on Science, Space, and Technology
House of Representatives
Washington, D.C. 20515

Dear Mr. Chairman:

In my testimony before your subcommittee on May 17, I emphasized the importance of biological diversity to the Forest Service and offered to provide specific comments that may be helpful in amending H.R. 1268 so that it responds to concerns we have.

We believe the Forest Service is presently the only Federal agency with a legislative mandate to conserve biological diversity. The National Forest Management Act of 1976 provides statutory direction for managing the National Forest System, and section 6(g) contains the diversity provision. Our interpretation and implementation of section 6(g) are described in the enclosure.

Maintaining biological diversity should not necessarily be equated with land and resource preservation. Within the multiple-use sustained-yield mission of the Forest Service, we develop and use forest and rangeland resources while still maintaining biological diversity. In fact, the maintenance of biological diversity often requires purposeful management of ecosystems to achieve desired conditions. It also requires a clear, well understood and widely accepted definition of what is meant by "maintaining biological diversity."

Biological diversity cannot be assessed or managed as a single entity. It is simply too complex. Choices have to be made on which aspects of diversity receive the highest priority in particular areas at particular times. That requires land managers to employ indicators of biological diversity: certain aspects of genetic resources, certain species, certain biological communities, certain ecosystems, and certain attributes of regional landscapes that represent major goals or concerns for biological diversity.

Taken in order of biological organization, criteria for indicators of biological diversity should start with the genetic variation upon which adaptability, resilience, and species productivity exist. Species currently in danger of extinction should be carefully managed for recovery and maintenance of population viability. Species that currently serve as human resources for commerce, agriculture, recreation, subsistence, or spiritual renewal should also receive attention. Goals for these species should include maintenance of population viability and enhancement of productivity where needed to meet human needs.

Distinct biological communities or ecosystems that are rare, unique, or highly productive elements of regional landscapes also warrant management attention. These might be approached as special habitats through concepts such as habitat elements (e.g., snags and fallen trees), management guilds (e.g., forest interior songbirds), plant associations, or selected stages of ecological succession (e.g., old-growth forests). Goals should address protection, restoration, or enhancement as needed to integrate their continued existence and function into regional ecosystems.

Finally, landscape attributes that are important in providing ecological linkages throughout an area might also serve as indicators of biological diversity. Examples include degree of habitat fragmentation, measures of connectedness between distinct ecosystems, and characteristics of corridors that facilitate plant and animal movements throughout the area.

A useful set of biological diversity indicators for an area should provide broad representation of the aspects of biological diversity that are of the highest immediate concern and of longest and most pervasive influence. This is a different use of the indicator concept than traditional attempts to select one of a small handful of species that supposedly indicate conditions of all the rest.

I cannot emphasize enough the importance of identifying both the indicators of diversity and criteria for their selection in an area (e.g., recovery, viability, productivity, resilience, resistance to pests, or linkages) during the NEPA process. Failure to clearly specify what a new mandate for biological diversity means within the framework of the NEPA process would result in never ending litigation for Federal ~~land management~~ agencies.

Key staff in our Washington Office who are available to assist your subcommittee include Hal Salwasser, National Forest System (235-8015); Mit Parsons, Legislative Affairs (447-5470); and Bob Szaro, Forest Environment Research (235-1071).

I would like the opportunity to meet with you to discuss these concepts, and I invite you to accompany me on a trip to one or more National Forests to see first hand how we are both planning and managing for the conservation of biological diversity.

Sincerely,

George M. Leonard

GEORGE M. LEONARD
Associate Chief

Enclosure

FOREST SERVICE LEGISLATIVE MANDATE TO PROVIDE FOR DIVERSITY OF PLANT AND ANIMAL COMMUNITIES

Section 6(g)(3)(B) of the Forest and Rangeland Renewable Resources Planning Act of 1974, as amended by the National Forest Management Act of 1976 (16 U.S.C. 1604) requires that National Forest land management planning regulations:

> "provide for diversity of plant and animal communities based on the suitability and capability of the specific land area in order to meet overall multiple-use objectives, and within the multiple-use objectives of a land management plan adopted pursuant to this section, provide, where appropriate, to the degree practicable, for steps to be taken to preserve the diversity of tree species similar to that existing in the region controlled by the plan."

There are two basic parts to this paragraph. First, it requires that the planning regulations include guidelines that provide for diversity of plant and animal communities in order to meet overall multiple-use objectives. Second, it requires that, within multiple-use objectives, National Forest plans should provide, where appropriate and to the degree practicable, for the preservation of tree species similar to that existing in the planning area.

To ensure that diversity is adequately considered pursuant to Section 6(g)(3)(B), the implementing regulations address diversity at several points.

36 CFR 219.3 defines diversity as "the distribution and abundance of different plant and animal communities and species within the area covered by a land and resource management plan."

36 CFR 219.26 establishes the minimum requirements for integration of diversity in the forest planning process and requires that (1) the responsible Forest Service line officer consider the the diversity of plant and animal communities and species during the planning process, and (2) the interdisciplinary team consider how diversity would be affected by various mixes of resource outputs and uses.

36 CFR 219.27 establishes the requirements for resource protection in the planning area that must be met in management of the National Forest System. Management prescriptions must "preserve" the diversity of plant and animal communities "where appropriate and to the extent practicable" within the overall multiple-use objectives of the Forest plan.

These requirements direct that, for the planning area (the area of the National Forest covered by a forest plan), information is collected, diversity is considered and evaluated, prescriptions are provided for diversity where appropriate, and reductions in diversity--including type conversions--are justified in terms of multiple-use objectives.

The Forest plan establishes the requirements, vision, and expectations for diversity through a set of multiple-use goals and objectives for the planning area. The Forest plan guides implementation through forest-wide standards and management prescriptions. All activities and projects must be consistent with the Forest plan. Each project or activity must be described and evaluated in terms of its effect upon the components of plant and animal diversity. Monitoring and evaluation of the collective effects of all projects and activities, including the addition of new information, determines whether Forest-wide requirements are being met and whether adjustments in the Forest plan are required.

United States
Environmental Protection
Agency

External Affairs (A-100AE)
Washington DC 20460

EPA

Legislative Analysis

July 20, 1989

Honorable James H. Scheuer, Chairman
Subcommittee on Natural Resources,
Agriculture Research, and Environment
Committee on Science, Space and Technology
U.S. House of Representatives
Washington, DC 20515

Dear Mr. Chairman:

We are pleased to respond to your questions directed to Dr. Peter R. Jutro of the Office of Research and Development as a follow up to his testimony before the Subcommittee on Natural Resources, Agriculture Research, and Environment hearing on the National Biological Diversity Conservation and Environmental Research Act (H.R. 1268).

Question 1. How do you view the interactions of the biodiversity program and the Environmental Monitoring and Assessment Program with the proposed Biological Diversity Center?

Response. The goal of EPA's Biodiversity Project is to assess the effects of climate change, land-use, pollution, and other stressors on biodiversity. The Environmental Monitoring and Assessment Program (EMAP) is being developed to determine the status of and trends in the condition of our nation's ecological resources. It will determine species and habitat distributions on regional scales, monitor changes in species distribution and biodiversity, and provide for regular reporting of status, trends, and changes in biodiversity on regional and national scales. As with most major EPA research programs, these actively involve cooperative projects with other Federal agencies and private groups to fulfill the Agency's research goals. The functions that H.R. 1268 would assign to the Center could duplicate existing EPA activities.

Question 2. Section 6 of H.R. 1268 sets out (a) the purpose, (b) the functions, and (c) the directives of the Center. Are any of these purposes, functions, and directives incompatible with the mission of the Agency?

Response. Although we see no apparent incompatibility with the proposed Center's activities relative to EPA's authority or regulations, the Administration believes that many of these functions could be effectively carried out with less expense under existing authorities. Accordingly, the Administration opposes the establishment of such a Center.

Science Advisory Board of the EPA?

Response. We ar~~e, at th~~is time, unable to respond to this question as there has as yet been no decision to create the Environmental Research Institute.

Question 4. Section 6(d) of H.R. 1268 would establish a governing board, which shall set the policies for and direct the Center. Would such a governing board be compatible with the existing organization of the Agency? If not, what ways would you suggest to correct the situation?

Response. Assuming that the Center were established, such a governing body may well be incompatible with the organization of EPA, or, in fact, any other Federal agency, in that most boards are advisory rather than managerial. As we understand the issue, a board generally cannot direct the operations of a governmental activity unless the activity is totally extramural. Therefore, if the Center is part of the Federal government, a part-time board cannot run it, whereas if the Center is a contractual entity created as an independent agent of the Federal government, such a board could run the Center.

The Office of Management and Budget has advised that it has no objections to the presentation of these views from the standpoint of the President's programs.

We appreciate the opportunity to provide you with our views on H.R. 1268. If we can provide you additional information, please do not hesitate contacting me.

Sincerely,

A. Henry Schilling
Director, Office of
Legislative Analysis

Question 3. If such a Center were to be established, what would be the advantages and disadvantages of placing the Center in the EPA?

Response. As stated above, the Administration opposes the establishment of such a Center. However, we recognize that biodiversity is a complex issue of major societal importance. Different agencies have historically interpreted it as meaning different things depending upon their particular jurisdiction. As we now know, biodiversity involves a broad range of interests and activities, and must be approached in a broad fashion.

An advantage of placing the Center at EPA, if one were established, is that EPA has extensive experience in investigating and dealing with such broad, comprehensive, long term issues in an integrated fashion. Additionally, as was indicated in the testimony, EPA has the existing scientific infrastructure to accomplish most of the ends the legislation foresees. A disadvantage of placing the Center at EPA is that there exists the possibility that the views and efforts of other agencies, some with historically greater involvement with the area, may be better represented if the Center were located elsewhere.

Question 3a. In which program would the management of the Center be placed if it were to be within EPA?

Response. Although the Administration does not believe that the creation of such a Center is warranted, if one were established at EPA, the Office of Research and Development seems to be the most appropriate location for it.

Question 3b. Should the purposes of the Center be expanded to include research on how to minimize stressors on biological diversity?

Response. Although we believe that work on the minimization of stress on biological diversity to be of critical importance, we believe that such research can be carried out by existing Federal agencies under current authorities.

Question 3c. If so, how should such research be carried out and at what cost.

Response. Such research would require a far broader range of expertise than envisioned for the Center, including expertise in engineering and several of the social sciences. This research, which would include projections of alternative mitigation strategies, should be integrated with other biodiversity research on taxonomy, ecological processes and vulnerability, but could likely be carried out by Federal agencies under existing law.

Question 3d. How might such a Center relate to the proposed Environmental Research Institute that has been recommended by the

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101st CONGRESS
1st Session

H. R. 1268

To establish a national policy for the conservation of biological diversity; to support environmental research and training necessary for conservation and sustainable use of biotic natural resources; to establish mechanisms for carrying out the national policy and for coordinating related activities; and to facilitate the collection, synthesis, and dissemination of information necessary for these purposes.

IN THE HOUSE OF REPRESENTATIVES

March 2, 1989

Mr. Scheuer (for himself, Ms. Schneider, Mr. Brown of California, Mr. Kastenmeier, Mr. Hochbrueckner, Mr. Henry, Mrs. Collins, Mr. Bates, Mr. Clarke, Mr. Roe, Mr. Fuster, Mr. Price, Mr. Beilenson, Ms. Pelosi, Mr. Owens of New York, Mr. Valentine, Mr. Akaka, Mr. Hamilton, Mr. Gilman, Mr. Nelson of Florida, Mr. de Lugo, Mr. Towns, Mr. Boehlert, Mrs. Saiki, Mrs. Morella, Mr. Bonior, Mr. Mineta, Mr. Walgren, Mr. Ravenel, Mr. Conyers, Mr. Schuette, Mr. Waxman, Mr. Wolpe, Mr. Lewis of Georgia, Mr. Carper, Mr. Lantos, Mr. Pallone, Mr. Smith of New Hampshire, Mr. Ritter, Mr. McDermott, Mr. DeFazio, Mr. Foglietta, Mr. Garcia, Mr. Downey, Mr. Hayes of Illinois, Mr. Jontz, Ms. Oakar, Mr. Atkins, Mr. Kostmayer, Mr. Gingrich, Mr. Porter, Mr. Evans, Mr. Mrazek, Mr. Mfume, Mr. Matsui, Mr. Cooper, Mr. Sabo, Mr. Fauntroy, Mr. Neal of North Carolina, Mr. Buechner, Mr. Hawkins, Mr. Ackerman, Mr. Borski, Mr. McHugh, Mr. Kennedy, Mr. Rangel, Mr. Rose, Mr. Levine of California, Mr. Moody, Mrs. Meyers of Kansas, Mr. Smith of Vermont, Mr. Vento, Mr. Sikorski, Mr. Pease, Mr. McMillen of Maryland, Mr. Levin of Michigan, Mrs. Boxer, Mr. Leland, Mr. Kolter, Mr. Leach of Iowa, Mr. Coyne, Mr. Berman, Mr. Ford of Tennessee, Mr. Owens of Utah, Mr. Edwards of California, Mr. Skaggs, Mr. Weiss, Mr. Oberstar, Mr. Bosco, Mr. Hughes, Mr. Lipinski, Mr. Nowak, Mr. Fish, Mr. Clay, Mr. Torres, Mr. Solarz, Mr. Ridge, Mr. Miller of Washington, Mr. Faleomavaega, Ms. Kaptur, Mr. Stark, Mr. Harris, Mr. Tanner, Mr. Dellums, Mr. Dixon, Mr. Yates, Mr. Shays, and Mr. McNulty) introduced the following bill; which was referred jointly to the Committees on Science, Space, and Technology and Merchant Marine and Fisheries

A BILL

To establish a national policy for the conservation of biological diversity; to support environmental research and training necessary for conservation and sustainable use of biotic natural resources; to establish mechanisms for carrying out the national policy and for coordinating related activities; and to facilitate the collection, synthesis, and dissemination of information necessary for these purposes.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled,

SECTION 1. SHORT TITLE.

This Act may be cited as the "National Biological Diversity Conservation and Environmental Research Act".

SEC. 2. FINDINGS.

The Congress finds that—

(1) the Earth's biological diversity is being reduced at a rate without precedent in human history, and this rate is certain to increase greatly in the near future;

(2) most losses of biological diversity are unintended and largely avoidable consequences of human activity;

(3) while the most rapid losses of biological diversity are occurring outside the United States, biological impoverishment is also a serious problem within the country;

(4) humans depend on biological resources, including plants, animals, and microorganisms, for food, medicine, shelter, and other important products;

(5) biological diversity is valuable as a source of intellectual and scientific knowledge, recreation, and aesthetic pleasure;

(6) reduced biological diversity may have serious consequences for human welfare as resources for research and agricultural, medicinal, and industrial development are irretrievably lost;

(7) reduced biological diversity may also endanger the functioning of ecosystems and critical ecosystem processes that moderate climate, govern nutrient cycles and soil conservation and production, control pests and diseases, and degrade wastes and pollutants;

(8) reduced biological diversity will diminish the raw materials available for scientific and technical advancement, including the development of improved varieties of cultivated plants and domesticated animals;

(9) existing information regarding the abundance and distribution of biological diversity is inadequate, often inaccessible, and frequently inapplicable to conservation management, thus hampering the efficiency of resource policy and management decisions;

(10) existing conservation laws largely address the protection of individual species that have already suffered declines, rather than focusing on maintaining ecosystem conditions that are necessary for sustaining healthy diversity across a broad range of species;

(11) maintaining biological diversity through habitat preservation is often less costly and more effective than efforts to save species once they become endangered;

(12) existing laws and programs relevant to the loss of biological diversity in the United States are largely uncoordinated and inadequate, and sometimes result in duplication of efforts, conflicts in goals, and gaps in geographic and taxonomic coverage;

(13) a comprehensive and coordinated Federal strategy is needed to arrest the loss of biological diversity and also, where possible, to restore biological diversity both through natural recovery and active management;

(14) increased biological and ecological research is needed to provide the knowledge to maintain biological diversity, to protect and manage ecosystems, and to ensure the sustainable use of natural resources;

(15) a policy that will contribute to a biological inventory, determine the rate and scale of the depletion

of biological diversity, and provide a model for the conservation of biological diversity is needed;

(16) increased understanding and appreciation by the public of the importance of biological diversity is necessary for effective conservation; and

(17) because it cannot be predicted which biological resources will be most important for future needs, maintaining the diversity of living organisms in their natural habitats is prudent policy.

SEC. 3. DEFINITIONS.

For purposes of this Act—

(1) the term "biological diversity" means the full range of variety and variability within and among living organisms and the ecological complexes in which they occur, and encompasses ecosystem or community diversity, species diversity, and genetic diversity;

(2) the terms "conserve", "conserving", and "conservation" refer to protective measures for maintaining existing biological diversity and active measures for restoring diversity through management efforts, in order to protect, restore, and enhance as much of the variety of species and communities as possible in abundances and distributions that provide for their continued existence and normal functioning, including the vi-

ability of populations throughout their natural geographic distributions;

(3) the term "ecosystem or community diversity" means the distinctive assemblages of species and ecological processes that occur in different physical settings of the biosphere and distinct parts of the world;

(4) the term "genetic diversity" means the differences in genetic composition within and among populations of a given species;

(5) the term "species diversity" means the richness and variety of species that inhabit the world or a particular location in the world; and

(6) the term "State" means each of the several States, the District of Columbia, the Commonwealth of Puerto Rico, the United States Virgin Islands, Guam, the Commonwealth of the Northern Mariana Islands, American Samoa, and any other commonwealth, territory, or possession of the United States.

SEC. 4. PURPOSES.

It is the purpose of this Act—

(1) to conserve the biological diversity of the United States by protecting, restoring, and enhancing as much of the variety of species and communities as possible in abundances and distribution that provide for their continued existence and normal functioning;

(2) to require explicit assessment of effects on biological diversity in all evaluations of the environmental effects of major Federal actions significantly affecting the quality of the human environment;

(3) to establish a Federal strategy for the conservation of biological diversity;

(4) to establish mechanisms for coordinating Federal, State, and private efforts to preserve biological diversity and natural environments;

(5) to undertake a nationally coordinated effort to collect, synthesize, and disseminate adequate data and information for—

(A) the understanding of biological diversity;

(B) assessing the rate and scale of the depletion of biological diversity; and

(C) identifying elements of biological diversity that are in decline or otherwise warrant special attention;

(6) to support basic and applied research necessary for the conservation of biological diversity; and

(7) to educate the citizens of the United States regarding the importance of biological diversity and foster actions that prevent biological impoverishment and preserve biological diversity and natural resources.

SEC. 5. NATIONAL BIOLOGICAL DIVERSITY AND ENVIRONMENTAL POLICY.

(a) POLICY.—It is the public policy of the United States that conservation of the biological diversity is a national goal, and conservation efforts are a national priority.

(b) BIOLOGICAL DIVERSITY CONTEXTS.—In implementing the policy set forth in subsection (a), biological diversity of the entire biosphere shall be considered in global, national, regional, and local contexts.

(c) CONSISTENCY OF FEDERAL ACTION.—The actions, policies, and programs of all Federal agencies shall be consistent with the goal of conservation of biological diversity, to the maximum extent practicable.

(d) AMENDMENTS TO THE NATIONAL ENVIRONMENTAL POLICY ACT OF 1969.—

(1) CLARIFICATION OF DIVERSITY PROVISION.—Section 101(b) of the National Environmental Policy Act of 1969 (42 U.S.C. 4331(b)) is amended by inserting "(including biological diversity)" after "which supports diversity".

(2) INCLUSION IN ENVIRONMENTAL IMPACT STATEMENTS.—Section 102(2)(C)(i) of such Act (42 U.S.C. 4332(2)(C)(i)) is amended by adding at the end the following: "including the impacts on biological diversity,".

(e) AGENCY REVIEW PROCESS.—(1) Each Federal department or agency shall, within 1 year after the date of the enactment of this Act and annually thereafter—

(A) review its programs, both individually and cumulatively, for consistency with the conservation of biological diversity in accordance with this Act, paying particular attention to especially endangered biological systems; and

(B) report the results of such review to the President, the Council on Environmental Quality, and the Congress.

(2) With respect to a program found to be inconsistent with the conservation of biological diversity in accordance with this Act, the relevant department or agency shall—

(A) undertake any modifications within its authority to eliminate such inconsistency;

(B) propose any legislation which may be necessary to reduce such inconsistency, to the maximum extent practicable; and

(C) submit a statement in its annual budget request to the Congress supporting and justifying the continuation of the program despite its adverse impacts on biological diversity.

(f) COUNCIL ON ENVIRONMENTAL QUALITY.—The President's Council on Environmental Quality shall—

(1) within 1 year after the date of enactment of this Act, establish guidelines, in consultation with the National Scientific Advisory Committee on Biological Diversity established under section 10 (hereafter in this Act referred to as the "Scientific Advisory Committee"), for consideration of biological diversity in the preparation of environmental impact statements; and

(2) identify, in consultation with the National Center for Biological Diversity and Conservation Research established under section 6 (hereafter in this Act referred to as the "Center") and with other domestic Federal, State, and private organizations, and with international organizations, those biotic communities, species, and populations that appear to be in decline or in imminent danger of loss of viability, or are otherwise of special concern, and shall include such information in its annual report.

(g) REVIEW OF ENVIRONMENTAL IMPACT STATEMENT BY EPA.—The Administrator of the Environmental Protection Agency shall review and comment in writing on the adequacy of each environmental impact statement prepared under the National Environmental Policy Act of 1969 in assessing biological diversity impacts.

SEC. 6. NATIONAL CENTER FOR BIOLOGICAL DIVERSITY AND CONSERVATION RESEARCH.

(a) ESTABLISHMENT AND PURPOSE.—There is established a National Center for Biological Diversity and Conservation Research (the Center), whose primary purpose shall be to set research priorities and provide leadership and coordination for the understanding and promotion of knowledge of the biota with respect to its composition, systematics, distribution, status, biological properties, and ecological relationships (including environmental significance), and the effects, including the rate and scale of depletion, on the biota of the activities of people, and to make this knowledge accessible to the people of the United States, and others working to conserve biological diversity throughout the world.

(b) FUNCTIONS.—The functions of the Center shall be—

(1) to summarize and enhance the knowledge of the distribution, status, and characteristics of the biota, as described in subsection (a), in a manner that can be used in conservation and management;

(2) to prepare, with the assistance of agencies and other sources, lists of—

(A) biotic communities, species, and populations that appear to be in decline or in imminent danger of loss of viability;

(B) areas of outstanding ecological or biotic importance; and

(C) communities, species, populations, and areas that warrant special concern;

(3) to provide information useful to—

(A) the Interagency Working Committee on Biological Diversity established under section 7 (hereafter in this Act referred to as the "Interagency Committee") in the preparation of the Federal strategy for conservation of biological diversity described in section 8; and

(B) the various agencies responsible for the implementation of such strategy;

(4) to publish information, such as floral and faunal treatises, resource inventories, vegetation maps, atlases, and guides for practical use of biological information, and especially publications that synthesize information relevant to national goals of understanding and conserving biological diversity;

(5) to identify taxonomic groups, ecological communities, and geographical areas in need of study, and to develop a strategic plan for, initiate, and provide financial support toward an ongoing survey of the biota;

(6) to provide for the conducting of field surveys, through contracts or otherwise, by Federal, State, and

private agencies, institutions, organizations, and individuals;

(7) to make recommendations with respect to the use of the latest technology for data collection, storage, and retrieval;

(8) to provide training and technical assistance regarding collection and interpretation of biological data; and

(9) to conduct supplementary research, as appropriate.

(c) DIRECTIVES.—In carrying out its functions under subsection (b), the Center shall—

(1) establish a cooperative network of Federal, State, and private agencies, institutions, and organizations for the collection and coordination of information regarding the status of biological diversity;

(2) oversee a review of existing information on biological diversity, including data bases;

(3) collect data and develop biotic information, with respect to aquatic and marine systems as well as terrestrial systems, that is relevant and applicable to resource management and conservation decisions;

(4) work closely with the national network of State natural heritage programs;

(5) cooperate with international data collection and coordination centers; and

(6) raise additional funds as necessary to support the activities of the Center.

(d) STRUCTURE AND MEMBERSHIP.—

(1) GOVERNING BOARD.—The Center shall have a governing board, which shall set the policies for and direct the Center.

(2) MEMBERSHIP.—(A) The governing board shall consist of 12 members, including—

(i) 1 representative of the Smithsonian Institution;

(ii) 1 representative of the Fish and Wildlife Service;

(iii) 1 representative of the National Marine Fisheries Service;

(iv) 1 representative of the National Science Foundation;

(v) 1 representative of the Agricultural Research Service;

(vi) 1 representative of the Environmental Protection Agency;

(vii) 1 representative of State biological surveys;

(viii) 1 representative of private organizations that maintain large data bases oriented toward biological conservation;

(ix) 2 scientists from nonprofit research institutions; and

(x) 2 representatives from institutions with collections of biological specimens.

(B) Members listed under clauses (vii) through (x) of subparagraph (A) shall be appointed by the President from a list of nominees recommended by the National Academy of Sciences. Such list of nominees shall include not more than twice as many names as there are positions available.

(3) TERMS.—Members of the governing board shall serve for terms of 5 years, and may serve more than one term.

(4) PER DIEM.—Members of the governing board who are not employees of the United States shall each be paid at a rate equal to the daily equivalent of the minimum annual rate of basic pay in effect for grade GS-16 of the General Schedule for each day (including travel time) during which they are engaged in the actual performance of duties vested in the governing board.

(5) CHAIRMAN.—The members of the governing board shall select 1 member to serve as chairman.

SEC. 7. INTERAGENCY WORKING COMMITTEE ON BIOLOGICAL DIVERSITY.

(a) ESTABLISHMENT.—There is established an Interagency Working Committee on Biological Diversity (the Interagency Committee).

(b) MEMBERSHIP.—The Interagency Committee shall consist of 1 representative each from—

(1) the Bureau of Land Management;

(2) the National Park Service;

(3) the Fish and Wildlife Service;

(4) the Forest Service;

(5) the Department of Defense;

(6) the Environmental Protection Agency;

(7) the National Marine Fisheries Service;

(8) the National Science Foundation;

(9) the Agricultural Research Service;

(10) the Soil Conservation Service;

(11) the Center;

(12) the Army Corps of Engineers; and

(13) the Council on Environmental Quality.

(c) CHAIRMAN.—The member of the Interagency Committee representing the Council on Environmental Quality shall serve as Chairman of the Interagency Committee.

(d) FUNCTION.—The function of the Interagency Committee shall be to prepare a coordinated Federal strategy for conservation of biological diversity described in section 8.

(e) DISSOLUTION.—The Interagency Committee shall be dissolved two years after the date of the enactment of this Act.

SEC. 8. FEDERAL BIOLOGICAL DIVERSITY STRATEGY.

(a) DEVELOPMENT.—The Interagency Committee, with the advice and guidance of the Scientific Advisory Committee, shall develop a coordinated Federal strategy for the conservation of biological diversity (hereafter in this Act referred to as the "Strategy").

(b) CONTENTS.—The Strategy shall address—

(1) the responsibility of each Federal agency to conserve biological diversity;

(2) methods of interagency cooperation, such as bioregional management of ecosystems;

(3) Federal involvement in non-Federal sectors;

(4) conservation through protective measures to maintain existing biological diversity, and through active measures to restore biological diversity;

(5) identification of habitats of special concern and methods to protect them:

(6) prevention of anthropogenic biological extinctions;

(7) provisions for the long-term viability of ecosystems and ecosystem processes;

(8) maintenance of gene pools through combination of in situ and ex situ techniques;

(9) use of demonstration areas, such as biosphere reserves;

(10) enhancement of scientific knowledge through improved and more complete biological surveys;

(11) research programs to identify factors limiting population viability or persistence;

(12) improvement of management techniques based on scientific knowledge;

(13) methods to encourage conservation-oriented thinking and ecological awareness in public and private decisionmaking;

(14) broad-based educational efforts regarding the importance of biological diversity and the need for conservation;

(15) consistency with the Strategy in international actions of Federal agencies; and

(16) development of criteria for evaluating the progress of Federal agencies toward implementing the Strategy.

(c) REPORTS.—(1) Within one year after the date of the enactment of this Act, the Interagency Committee shall submit to the Congress a report detailing progress made toward development of the Strategy.

(2) Within two years after the date of the enactment of this Act, the Interagency Committee shall submit to the Congress a report containing the completed Strategy, including written comments by the Scientific Advisory Committee and the public, and including a statement explaining any difference between the completed Strategy and the recommendations of the Scientific Advisory Committee. Such report shall be signed by the head of each agency represented on the Interagency Committee.

(3) At least once every two years after the submission of a report under paragraph (2), the head of each agency which was represented on the Interagency Committee shall submit to the Congress a report—

(A) detailing progress in the implementation of the Strategy, including written comments by the Scientific Advisory Committee and the public; and

(B) including a statement explaining any difference between the implementation of the Strategy and the recommendations of the Scientific Advisory Committee.

SEC. 9. GRANTS, RESEARCH, AND TRAINING.

(a) BIOLOGICAL DIVERSITY GRANTS.—

(1) GRANTS.—Each agency which was represented on the Interagency Committee may engage in partnership grants with public agencies, including State natural heritage programs and State natural resource agencies, private individuals, and organizations for projects to maintain or restore biological diversity through research, resource management, personnel training, public education, or otherwise.

(2) SMALL-SCALE PROJECTS.—Grants issued under paragraph (1) shall include small-scale projects by private individuals and grassroots organizations.

(3) GUIDELINES AND REVIEW PROCEDURES.—Agencies issuing grants under this subsection shall cooperate through the Scientific Advisory Committee in setting guidelines and competitive review procedures for grant proposals.

(4) MATCHING FUNDS.—Federal funds made available for grants under this subsection must be matched in cash or in kind on at least an equal basis by the grantee, except in the case where the grantee is a State or where the grant is provided for research.

(b) ENVIRONMENTAL RESEARCH AND TRAINING.—

(1) PRIORITY.—Each agency which was represented on the Interagency Committee shall, where appropriate to its mission, give high priority to research-

and personnel training towards implementation of the Strategy.

(2) ADEQUACY ASSESSMENT.—Within two years after the date of the enactment of this Act, each agency which was represented on the Interagency Committee shall conduct an assessment of its environmental research and training programs to determine their adequacy for—

(A) long-term ecological research and monitoring;

(B) development of programs to train personnel in basic principles of ecology and systematics; and

(C) public education regarding biological diversity,

and shall improve those programs determined to be inadequate. The results of such assessment, and a summary of actions taken to improve such programs, shall be included as part of the final report of the Interagency Committee submitted under section 8(c)(2).

SEC. 10. NATIONAL SCIENTIFIC ADVISORY COMMITTEE ON BIOLOGICAL DIVERSITY.

(a) ESTABLISHMENT.—There is established a National Scientific Advisory Committee on Biological Diversity (the

Scientific Advisory Committee), which shall be a permanent entity.

(b) FUNCTIONS.—The functions of the Scientific Advisory Committee shall be—

(1) to oversee the implementation of the Strategy;

(2) to provide scientific and technical advice and counsel to the Interagency Committee in the preparation of the Strategy to ensure that the best possible scientific information is used in developing the Strategy;

(3) to provide scientific and technical assistance to the agencies of the United States responsible for the implementation of the Strategy;

(4) to assist in the coordination of interaction between the agencies which were represented on the Interagency Committee and the Center;

(5) to provide scientific and technical assistance in—

(A) the evaluation of the impacts of proposed Federal actions on biological diversity;

(B) the review of Federal programs for consistency with the conservation of biological diversity; and

(C) the assessment of the adequacy of Federal programs in environmental research and training; and

(6) to provide a general reference and scientific and technical advisory resource for the Nation in matters relating to conservation of biological diversity.

(c) MEMBERSHIP AND STRUCTURE.—

(1) MEMBERSHIP.—(A) The Scientific Advisory Committee shall consist of 15 members, including—

(i) the Director of the Center;

(ii) one representative of the governing board of the Center;

(iii) one representative of the Smithsonian Institution; and

(iv) 12 scientists from Federal or State agencies, universities, nonprofit research institutions, nongovernmental organizations, and natural resource industries with particular expertise in the area of biological diversity.

(B) Members listed under clause (iv) of subparagraph (A) shall be appointed by the President from a list of nominees recommended by the National Academy of Sciences. Such list of nominees shall not include more than twice the number of positions available. The President shall make such appointments so as to ensure that the Scientific Advisory Committee membership is diverse disciplinarily and geographically.

(2) TERM OF OFFICE.—(A) Except as provided in subparagraph (B), members of the Scientific Advisory Committee shall be appointed for 3-year terms, and no member may serve more than 2 consecutive terms.

(B) Of the members initially appointed under paragraph (1)(A)(iv), 4 shall be appointed for 1-year terms and 4 shall be appointed for 2-year terms.

(3) CHAIRMAN.—The members of the Scientific Advisory Committee shall elect 1 member to be chairman.

(4) PER DIEM.—Members of the Scientific Advisory Committee who are not employees of the United States shall each be paid at a rate equal to the daily equivalent of the minimum annual rate of basic pay in effect for grade GS–15 of the General Schedule for each day (including travel time) during which they are engaged in the actual performance of duties vested in the Scientific Advisory Committee.

(d) REPORTS.—Within 3 years after the date of the enactment of this Act, and once every two years thereafter, the Scientific Advisory Committee shall submit a report to the Congress and the Council on Environmental Quality describing activities taken under this Act.

(e) ADMINISTRATIVE AND STAFF SUPPORT.—The Scientific Advisory Committee shall receive from the Council on Environmental Quality such administrative and staff support as may be necessary to carry out its functions.

SEC. 11. AUTHORIZATION OF APPROPRIATIONS.

(a) AUTHORIZATIONS.—There are authorized to be appropriated for the activities of the grants program under section 9 and for the activities of the Center under section 6—

(1) $5,000,000 for the fiscal year ending September 30, 1990;

(2) $10,000,000 for the fiscal year ending September 30, 1991; and

(3) $10,000,000 for the fiscal year ending September 30, 1992.

(b) LIMITATION.—Expenditures in any fiscal year of funds appropriated under this section for grants under section 9 shall not exceed 10 percent of the total amount appropriated under this section for such fiscal year. Funds appropriated under this section shall be in addition to sums authorized and appropriated under any other Act.

Analysis of the Range of Institutional Options Available to House a Proposed National Center for Biological Diversity and Conservation Research

Staff Paper
Food and Renewable Resources Program
Office of Technology Assessment
Congress of the United States

May 1989

The views expressed in this OTA Staff Paper do not necessarily represent the views of the Technology Assessment Board, the Technology Assessment Advisory Council, or individual members thereof.

The House Committee on Science, Space, and Technology, in January, 1989, requested the Office of Technology Assessment to conduct a brief analysis of the range of institutional options available to house the National Center for Biological Diversity and Conservation Research as proposed in the National Biological Diversity Conservation and Environmental Research Act (H.R.1268). OTA gathered the following information through a mail survey, meetings, and interviews with experts involved in various aspects of biological diversity data collection.

The key to determining the location of the Center seems to lie in the functions of the Center. Included among its many proposed responsibilities in the bill are to:

1) review existing information on biological diversity, especially with respect to databases;

2) develop a coordinated network of databases;

3) identify taxa in need of further study;

4) develop a national biological inventory;

5) publish flora and faunal treatises;

6) prepare lists of populations, species, and communities that appear to be in decline;

7) develop a small-grants program to assist public and private endeavors to survey the biota of different localities;

8) work closely with the Federal interagency task force and the Council on Environmental Quality (CEQ).

To accomplish these tasks, any institution would have to have the capability to forge cooperation and trust among government agencies, academic institutions, and private organizations. The OTA study, Technologies to Maintain Biological Diversity, found that much information on the biota is already available but not in an assimilated form useful to decisionmakers. Consolidation of these data is necessary to identify gaps, to provide a comprehensive understanding of the status of the Earth's biota, and especially to define priorities for action. The Center would, among other things, coordinate data exchanges through existing databases (not necessarily create new databases) and coordinate grant giving and contractual relationships with groups or individuals that could fill information gaps concerning biological diversity.

Currently, no existing institution seems ideally suited to handle all the responsibilities. Therefore, meeting these responsibilities would require expansion of an existing institution's mission, or creation of a new institution.

Establishing a new separate entity seems appealing because it would not have the institutional biases of existing institutions and, thus, might have a better chance to enlist cooperation and participation of existing agencies. On the other hand, uncertainty exists as to whether a new Center would have the necessary resources to carry out its mission, especially in these budget-conscious times. It may not be politically feasible to create a new institution when existing ones can be pressed into service even though existing agencies have strong agendas of their own and the Center may not easily fit any of their current agendas.

With regard to existing institutions, The Nature Conservancy (TNC) comes closest to meeting the intent and major functions of the Center. This private, not-for-profit organization currently maintains the most complete and accurate databases on the biota of North America. It has the technical expertise and experience to accomplish many of the tasks outlined in the legislation. No other private organization or Federal agency has similar qualifications. Yet the main reason to eliminate TNC from consideration would be that it is a private organization viewed by Federal agencies and other organizations as a special interest group. Such perception would be a major constraint to obtaining full cooperation from the diversity of groups working on biological data collection.

Accountability of a private organization to Congress might be another constraint, but a variety of mechanisms exist that could ensure accountability. Moreover, placing a federally-funded program within a not-for-profit, free-standing organization might be detrimental to TNC itself. TNC's best activities come through its effort to preserve environments for species through appeal to the public for donations and for support.

The advantages for locating this Center in the Federal government seems to outweigh the advantages for locating it outside the government. By being in the Federal government, the institution would have greater potential to influence and effect policy and institutional changes that would improve biological diversity conservation. If the Center were located outside the Federal government, it might be difficult to persuade agencies to "buy-into" the Center's programs, findings, and suggestions.

However, a disadvantage of Federal agency location is the potential for politicizing the data and perhaps the Center's thrust and stability. Some Federal programs are not known for their stability and long-term endurance, especially those related to monitoring.

As to where the Center should be located in government, again the answer depends on the objectives to be achieved. If the Center is to be the national center for research and data collection only, then it might make sense to put it in the Smithsonian Institution. This institution would bring instant prestige and scientific credibility to the issue. The Smithsonian has shown the greatest interest in house thus far for the proposed Center and has suggested placing it physically on its Front Royal research property.

If the Center were located at the Smithsonian, it could be integrated into a multiplicity of ongoing programs. Those programs, however, might dilute the funds made available to the Center. For example, the Smithsonian has more of an interest and focus on international conservation than conservation within the United States and could potentially tap the Center's resources for primarily international work. On the other hand, opportunities probably exist for financial leverage at the Smithsonian which are denied Federal agencies.

Although an effective voice for science, traditionally the Smithsonian has not been a voice for modifying government operations or for creating policy initiatives. By charter, it cannot set governmental policy. Also, the institution is not keen on playing a policy or regulatory role. The Smithsonian's present institutional structure also cannot accept a governing board as established by the H.R.1268. Like the TNC, it probably also would have difficulty directing Federal agencies to comply with requests for assistance with data collection and exchanges. Therefore, if the Congress wants significant involvement by the Center in Federal policies and practices, then the Smithsonian Institution choice seems inappropriate.

If the primary objective of the Center is to influence government policy and practices, then the CEQ becomes an obvious contender. Although CEQ is not immune to budget changes and withdrawal of political support, it does maintain its statutory responsibilities including those for environmental data. It probably could carry out this mission if it received an adequate budget. On the other hand, because CEQ is driven by a political agenda, its data could be viewed as subject to question. Also, CEQ has no proven track record in administering and operating large programs.

If the proposed Center were to have a mixture of policy and research responsibilities, then either the Fish and Wildlife Service (FWS) of the Department of the Interior or the Environmental Protection Agency (EPA) could be legitimate homes. FWS has the advantage of a tradition of research, policy formulation, and management in the area of biotic conservation in response to its multiple legislative authorities. Conversely, FWS has been criticized for not taking a broad approach to conservation (e.g., defines wildlife primarily as game species) and for inadequately administering existing legislatively-mandated programs (e.g., the Endangered Species Program).

EPA seems a more likely candidate than FWS because it is both a scientific and regulatory agency with a large budget directed at protecting the environment. Currrently, it also is considering the development of a new large-scale ecosystems monitoring program. Of the several proposals being circulated, the one from the EPA's Office of Research and Development (ORD) on "Environmental Monitoring and Assessment Program" (EMAP) is the most pertinent to this discussion. The intent of EMAP is to monitor on a national scale the health of the environment through periodic evaluation of a sample of different types of ecosystems (e.g., forest, freshwater wetlands). Biological diversity data would be one indicator of environmental health.

The Center also could become part of the proposed Environmental Research Institute. The proposal is one of ten recommendations from the Science Advisory Board of EPA to improve strategic research planning at EPA. One function of this Institute would be to collect all relevant ecological data and use the data to assess trends in ecological quality, and those trends described in an annual report to the nation on the overall quality of the environment. The head of the Institute would report to the EPA Assistant Administrator of ORD but the Institute would be governed by an independent board of scientists, not unlike the governing board proposed in the legislation.

It is too early to ascertain which of these proposals, if any, will be promoted by the agency or by Congress. But it seems worthwhile at least to monitor the progress of various deliberations of these proposals, given that the Science, Space, and Technology Committee has authorization jurisdiction over EPA.

Another possibility is to split the functions of the Center. For example, one agency could manage the databank and handle four functions described in the legislation: 1) review existing information on biological diversity; 2) develop a coordinated network of databases; 3) identify taxa in need of further study; and 4) develop a small-grants program to fund biotic surveys. Another agency, for instance, then could use the data to prepare lists of species and communities at risk of decline. If the responsibilities of the Center eventually were split, it would be crucial that a single Cabinet-level official retain lead responsibility so that accountability is clear. It is also important to report to Congress on a regular basis on progress in carrying out those mandates. Reporting provides the bases of dialogue between branches of government and keeps the activity focused at a high level in government.

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DAVID E. BLOCKSTEIN

Toward a Federal Plan for Biological Diversity

We can deepen and expand current programs to build a comprehensive network for conservation.

Protection of human health has long been one of the chief goals of public policy. But human health is dependent upon environmental health, which in turn depends upon biological diversity. A wide variety of genes, species, communities, and ecosystems provide the natural resources (such as food, medicine, and shelter) for daily subsistence and the ecological "services" (such as climate moderation, nutrient recycling, and breakdown of wastes) necessary for the long-term survival of all life on Earth.

Unfortunately, policymakers are just coming to recognize these dependencies as the natural storehouse of biological resources and ecological services is being diminished in all parts of the world at rates unprecedented in human history. The next few decades could see a level of global extinction rivaling that at the end of the Cretaceous period 65 million years ago (when the dinosaurs, as well as half of all animal species, died out). In addition to extinctions, populations of common species—from migratory birds to wild relatives of agricultural plants—are showing declines throughout the world. These losses may have serious consequences, ranging from the elimination of resources (present and potential) to major ecological disruptions.

Damaged habitats can be restored to a certain degree; and endangered species can sometimes be recovered, albeit at considerable expense; but extinction, described by conservation biologist Michael Soulé as "the death of birth," is final. Biotechnology has given us the ability to move genes from organism to organism, but we cannot create genes.

Piecemeal and reactive policies

The loss of biological diversity results inadvertently from the activities of a rapidly expanding human population. Although such loss is largely avoidable, current U.S. policies have addressed only pieces of this issue. A 1987 study by the Office of Technology Assessment (OTA) found an ad hoc nonsystem that "is too disjunct to address the full range of concerns over the loss of biological diversity." Federal efforts are ineffective, according to the study, basically because of a lack of recognition of the importance of diversity.

David E. Blockstein, an assistant professor of zoology at Connecticut College (New London), was a 1987–88 Congressional Science Fellow of the American Institute of Biological Sciences and the American Society of Zoologists.

Consequently, there is a lack of useful information about diversity and a fragmented and uncoordinated patchwork of protection activities. Although there are separate laws dealing with endangered species, coastal wetlands, wild and scenic rivers, and marine mammals, for example, no federal law specifically mandates the maintenance of biological diversity—either *in situ* (in natural environments) or *ex situ* (in storage facilities, from germ plasm banks to zoos)—as a national goal.

Existing conservation efforts are largely reactive, the study showed. They are aimed at recovery of species that are already on the verge of extinction rather than at prevention of future losses. This approach is typified by the Endangered Species Act (ESA), a "safety net" that is sagging under the strain of the sheer magnitude of species needing attention. The rate of extinctions in the United States may now exceed the rate of listing for candidate endangered species (some 25 per year). For many of the listed species, recovery plans have not yet been completed.

Although the listing and recovery programs are likely to be improved by increased funding allowances in the 1988 reauthorization of the ESA, they are only a last-chance approach for preserving biological diversity. The ESA should be viewed as analogous to Superfund, a way to try to mitigate disasters that have already occurred. Just as the Toxic Substances Control Act and the Resource Conservation and Recovery Act were designed to prevent the need for future Superfund actions, we need a comprehensive federal plan to prevent the need for future listings of endangered species. Its focus must be broadened from a species-by-species program to conservation of entire habitats.

A federal conservation strategy

Because biological resources are within the jurisdiction of many federal and state agencies and are variously used and abused by a wide range of private-sector groups, considerable coordination will be required for effective conservation. The OTA study recommends developing an explicit federal policy that would pinpoint areas of overlap and neglect under current operations, as well as identifying the responsibilities of each agency and coordinating their activities. This approach is embodied in the National Biological Diversity Conservation and Environmental Research Act (H.R. 1268), which was introduced in March by Representative James Scheuer (D-N.Y.), chairman of the Natural Resources Subcommittee of the House Science Committee, along with more than 100 other cosponsors. A version of Scheuer's bill has been introduced in the Senate by Senator Albert Gore (D-Tenn.) as part of a global environmental protection bill (S. 201).

Scheuer's bill, very similar to the one (H.R. 4335) that was approved by the natural resources subcommittee in the previous session of Congress, provides for the development of an integrated federal strategy by an interagency committee—drawn from all agencies with resource management, ecological research, and environmental oversight responsibility—in cooperation with a scientific advisory committee. The legislation provides a two-year period for the development of the strategy, with biennial reports by each agency on its implementation.

In order to provide a comprehensive approach to biological conservation, I believe that the strategy should proceed on four fronts: science, protected areas, seminatural areas, and ecological recovery.

Science. Policymakers and managers need to know the status of biological diversity in order to set priorities. For example, the private Center for Plant Conservation (CPC) recently surveyed botanists regarding endangered plants in the United States, and they found that 253 species face a real risk of extinction in the next five years. Another 427 species could disappear by the end of the century. About 75 percent of these critically endangered plants are found only in Hawaii, California, Texas, Florida, and Puerto Rico.

A first step in conserving biological diversity is to process such information and make it accessible. A massive federal data base would be unwieldy; on the other hand, a data base of data bases could monitor trends in diversity. But as Peter Raven, director of the Missouri Botanical Garden, told a House science subcommittee in June 1988, merely reshuffling old data is inadequate. A national biological survey, coupled with a global survey of ecosystems, would fill in the gaps.

In a 1985 article in this magazine, E. O. Wilson of Harvard University advanced a proposal for a complete catalog of species of the world, which could be compiled at a low cost relative to other Big Science projects. While this time-consuming endeavor is under way, however, a "quick and dirty" global survey, as called for by Thomas Lovejoy of the Smithsonian Institution, should be undertaken. Such a survey would focus on a few taxonomic groups to locate areas with high diversity and to identify those that are most endangered. On a national level, inventories should focus initially on locations with the most diversity at risk, such as those identified by the CPC study, and on federal lands with the greatest potential for conflicts between conservation and resource extraction.

> *Conserving biological diversity must entail four elements: research, creation of protected areas, utilization of semi-natural areas, and recovery of endangered species.*

Many of the problems of an inadequate and inaccessible biological data base may be solved by the proposed National Center for Biological Diversity and Conservation Research, which is a part of Scheuer's bill. The purpose of the center—to summarize, enhance, and interpret data regarding the distribution, status, and characteristics of biological diversity—will be accomplished by creating a network of organizations that collect biological data, by supporting additional biological survey work, and by translating this information into forms useful to managers and policymakers. If the center receives the appropriations called for in the bill ($25 million over three fiscal years), it should significantly expand our knowledge of biological diversity and help facilitate enlightened conservation-policy decisions.

We must also move forward on goal-oriented research for diversity conservation; factors that limit the abilities of populations to exist must be identified and techniques to mitigate these limiting factors developed. Although the National Science Foundation (NSF) funds research related to conservation, it has no specific mechanism for funding basic and applied research in conservation biology. Changes may be in the offing, however; the NSF budget request for FY 1990 includes $11 million for research on biological diversity. Although it is not yet clear how NSF would broaden its programs, the land management agencies (such as the National Park Service) should begin reassessing their research and development programs with conservation in mind.

For example, a key element of conservation biology is the linkage between *in situ* and *ex situ* methods. Although diversity is best conserved in the natural environment, *ex situ* storage is sometimes an essential temporary step. Much research is needed, however, regarding the transfer of technologies developed for captive species to conservation of wild species, as well as on how to transplant populations from reserves into former habitats.

Protected areas. Undoubtedly, the best way to preserve organisms is through the creation and maintenance of protected areas in sufficient number and of adequate size. In the United States, the national parks, forests, and wildlife refuges approximate a national biological-diversity reserve system. Because these areas were not established to preserve diversity, however, they fail on two counts:

First, the "system" is incomplete and many of the reserves are in the wrong places. According to a Department of the Interior report on areas of at least 23,000 acres, land administered by the four largest federal land management agencies failed to include 22 percent of the recognized ecosystem types in the United States and underrepresented another 29 percent. Researchers mapping the location of endangered forest birds in Hawaii in the 1970s found that the locations of the protected areas did not coincide with the locations of the species that most needed protection.

Second, conflicts occur between the extraction and conservation of resources. The national park system attempts a delicate balancing act between tourism and preservation. The national forests and lands administered by the Bureau of Land Management operate under a policy of multiple use and sustainable yield, in which ecological integrity is but one goal.

Despite their shortcomings, existing protected areas—federal, state, and private—could serve as the base of an ecologically complete system; preservation of multiple examples of all the natural communities occurring within the United States should be a national goal. Designation and purchase of additional habitats will clearly be needed, based on improved matching of locations of ecosystems and reserves.

The biological diversity bill does not directly address the need for completing the system of ecological reserves. But this could be a part of the interagency strategy, which would feature "identification of habitats of special concern and methods to protect them." Support could be provided from the federal Land and Water Conservation Fund (LWCF), which is funded largely from receipts from offshore oil and gas leases. For over 25 years, the LWCF has provided $3.6 billion for the purchase of 3.2 million acres of park, refuge, and recreation land.

Because only a small proportion of the available funds were appropriated during the Reagan years, Representative Morris Udall (D-AZ), chairman of the House Interior Committee, introduced legislation (H.R. 876) to turn the LWCF into a dedicated trust that would be independent of yearly appropriations. Udall's American Heritage Trust Act would create a fund for acquisition that would be self-supporting in five years with a projected $1 billion of interest available annually. This bill, with over 200 cosponsors, was recently approved by the Interior Committee. Congress should quickly adopt it and direct that a substantial proportion of the money be used to purchase biological diversity reserve areas.

Seminatural areas. The third, and largely ignored, front is what James Brown of the University of New Mexico has called "the seminatural matrix"—areas directly affected by humans, but in which some natural elements persist. If our conservation policies fail to affect this habitat we will be unable to maintain diversity; there simply will never be enough protected areas to do the job.

The biological diversity bill could well have its greatest impact here. The activities of all federal agencies, from the location of highways and dams to the use of tree species in erosion control, affect this seminatural matrix. Existing and new programs should be reviewed in consultation with scientific experts to minimize inadvertent threats to biological resources. Scheuer's bill calls for such a programmatic review, in which agencies could work together to manage the land as ecosystems rather than as isolated political units. Recent interagency agreements for the management of the Greater Yellowstone area and the Great Smokies are good examples of such an approach.

Federal permits are required for many actions; clear directives on how to minimize biological impoverishment while continuing development could head off potential problems. The "environmental impact statement," prepared under the National Environmental Policy Act (NEPA), is an important tool in this regard. But although such statements rarely discuss impacts on biological elements other than endangered species, the biological diversity bill explicitly requires that they do so. The bill directs the Council on Environmental Quality, which oversees the NEPA process, to draw up guidelines showing land-use planners how to assess potential impacts on local biota. Moreover, such federal guidelines would likely be adopted by states, many of which have their own "mini-NEPAs."

Ecological recovery. Biological conservation also entails the continuance of "emergency room care" for those species and ecosystems on the brink of extinction. Although recovery is expensive, the costs may be small compared to the benefits otherwise foregone. Increased funding for endangered species recovery will be necessary to prevent "de facto triage," a situation in which there is only enough money to save some of the species at risk.

Funding must be adequate for the Fish and Wildlife Service to complete the listing process for all 2,000 to 3,000 candidate endangered species, develop recovery plans for each species (including those presently listed), and implement the recovery plans. The 1988 reauthorization of the Endangered Species Act provides additional protection for endangered plants and increased authorization levels; its success depends largely on the amount of appropriations that are allowed.

Early identification of rare and declining species, expedited by a comprehensive biological survey and monitoring program, should minimize the need to add candidate species in the future. The National Center for Biological Diversity proposed by Scheuer will be very useful in this regard, as long as it maintains close ties with the FWS monitoring programs.

International initiatives

The above approach to conserving biological diversity need not be restricted to the United States. Its four elements—research, creation of protected areas, utilization of seminatural areas, and recovery of endangered species—are essential to the success of any nation's conservation strategy. Techniques of research, inventory, and monitoring are easily exportable and can be tailored to a particular country's needs.

Currently, Congress has been more eager to deal with the loss of biological diversity abroad than at home. Acting on congressional instructions, the Treasury Department has directed U.S. representatives to multilateral development banks to oppose funding for projects that would destroy tropical wetlands and rain forests, habitats high in diversity. Environmentalists, both within and outside Congress, are trying to rewrite the Foreign Assistance Act so that U.S. aid will support only actions that are ecologically sound. The Agency for International Development has been directed by Congress to make conservation of biological diversity a high priority.

The United States, with its extensive scientific infrastructure, clearly has a leading role to play in the development of conservation programs throughout the world. But in order to be credible, we must first have our own house in order. Without a strong commitment by the U.S. government to conserve our own country's biological diversity, its efforts to convince impoverished nations to put off short-term gains for long-term availability of biological resources will be seen as hypocritical—and will ultimately be rejected.

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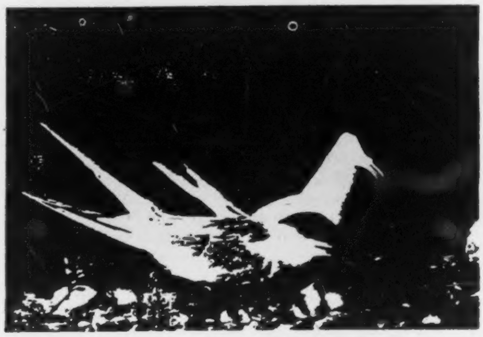
The Whole Earth Catalog

How do we preserve our plants and animals without completely preventing development? James Scheuer has an idea.

By

Bob Reiss



TERN CONCERNS *Common terns, unprotected, birds facing habitat destruction*

CONSIDER GREAT GULL ISLAND, OFF the tip of Long Island. A fort in World War II, only birds live there now—huge colonies of two species of terns, the Roseate tern and the common tern. Both species enjoy protection from human interference, since the island is owned by the Museum of Natural History. But the Roseate tern, an officially endangered species, is protected when it leaves the island, too. Its nesting areas are posted. The common tern, not listed as endangered, but dropping in population so fast that it may soon be . . . well, tough luck. No federal protection. The common tern will have to wait until it is almost extinct before it will be eligible to receive help.

Typical wrong way to do things, Congressman James Scheuer thinks.

"We've made a terrible mistake focusing on individual species instead of the entire ecosystem," he says.

Scheuer, a Democrat and representative of the Eighth Congressional District—which encompasses Great Neck, part of Queens, and part of the Bronx—is chairman of the House Subcommittee on National Resources, Agriculture Research, and Environment. He's proposed a new bill that could change the fundamental way that the United States approaches environmental issues.

The bill, called the "National Biological Diversity Conservation and Environmental Research Act," would require the U.S. to do something never before attempted in its 200-year history: Come up with a nationwide coordinated environmental strategy based on an inventory of all of the country's plants and wildlife. The work would be done by a National Environmental Center, established over the next three years at a cost of $25 million, complete with data banks available to federal agencies and planners. The center would implement strategies designed to protect biodiversity—not single species so much as entire ecosystems vital to national interests.

"The way we operate now doesn't work," Scheuer said recently during a lunch in the House Members dining room. "By the time we identify a species that's endangered, and go through all the administrative and bureaucratic hocus-pocus to get it declared endangered, how long does that take? Five, ten years? It's gone. And even if it isn't 100 percent gone, there's no way you can preserve it, because what you have to do is preserve the whole habitat, the whole ecosystem. Then you don't have to worry about diddly squat . . . the snaildarter."

In practical terms, it might work like this: Studies and statistics prepared by the center would be available to the federal agencies that decide whether to allow development of specific parcels of land. The agencies would then know not only what species resided on the land, but also the way in which the species interrelated with the environment, both locally and nationally. In the case of the common tern on Gull Island, for example, we would *know* the extent of the bird's existing habitat, and could draw more informed conclusions about the need to protect it.

"The earth's biological diversity is being reduced at a rate unprecedented in human history," the bill reads. "And this rate is expected to increase in the near future . . . . While the most rapid losses of biological diversity are occurring outside the United States, biologi-

ON THE ISLE

What can LIers do? Supporters of the biodiversity bill should write to their congressmen: Thomas Downey (4 Udall Rd., West Islip 11795); George Hochbrueckner (3771 Nesconset Hwy., Centereach 11720); Norman Lent (2280 Grand Ave., Baldwin 11510); Raymond McGrath (203 Rockaway Ave., Valley Stream 11580); Robert Mrazek (143 Main St., Huntington 11743); or James Scheuer (137-08 Northern Blvd., Flushing 11354).

cal impoverishment is also a serious problem within the country."

Such claims seem to be borne out by a recent report published by the General Accounting Office in Washington at the behest of the House Subcommittee on Fisheries and Wildlife Conservation. "In the 15 years since the Endangered Species Act of 1973 was enacted," it states, "few species have been reclassified as recovered, or even improved . . . ." It adds that of the 482 U.S. species currently listed as endangered, 137 are not likely to "ever fully recover." Among the major reasons for this prediction, it explains, is that "the species lack sufficient habitat" and that the "threats endangering the species are poorly understood."

Equally frightening statistics just issued by the Center for Plant Conservation near Boston charge that in the U.S., 3,000 species of higher plants are threatened with extinction. "The situation is precarious," says Dr. Thomas E. Lovejoy, assistant secretary for External Affairs at the Smithsonian Institution.

So precarious, in fact, that in the absence of a comprehensive federal environmental strategy, 19 botanical gardens around the country have begun emergency measures, growing endangered species. Not only could these plants turn out to be valuable repositories for fresh genetic strains to improve food crops, but they may turn out one day to offer means of curing diseases—currently, 25 percent of all prescription drugs in the U.S. come from plants.

Wood chips!" Congressman Scheuer cries, sitting with two aides in the House dining room, waving a pack of Saltines in the air. "Do you know nearly half of Hawaii's lowland forest was cleared in 1984 and 1985, in a subsidized project to get electricity from wood chips?" he says, outraged. "Most people don't know we have severely threatened rain forests in Hawaii."

Scheuer attacks his salad. "Take national parks," he says. "When preserves and parks are looked upon just as scenic wonders—when they want to preserve a few bison, a few bears—they ignore the whole length and breadth, the millions of small animals, insects, toads, frogs, that the tourists may not give a rat's ass about, but that are part of the biota, *that must be preserved!*

"And another thing: There's too much development. They're eroding our wetlands in New York, New Jersey, Florida. We're losing incredible biological diversity all over the East Coast."

It's hard to exert moral sway in the world if we're not trying harder in the U.S."

Scheuer has collected 120 cosponsors for the bill, which even opponents concede is a lot, and which includes other LI congressmen such as George Hochbrueckner, Robert Mrazek, and Thomas Downey. Another cosponsor is the ranking Republican on the Committee, Claudine Schneider of Rhode Island. Supporters outside of Congress abound. "This bill would stitch together the gaps in our environmental laws," says Lovejoy.

"This bill is absolutely crucial," adds Dr. Michael J. Balick, acting director of the New York Botanical Garden's Institute of Economic Botany, who is expected to testify before the subcommittee. "The loss of biological species is one of the tragedies of our time."

So far, principle opposition to the bill in the subcommittee has come from the American Forest Council, a Washington-based trade association of companies in timber-related industries. John Heissenbuttel, manager of forest policy research for the council, calls the bill "premature." The association supports the general idea of biodiversity, he said, but added that so far, nobody knows exactly what biodiversity is. For companies doing business on lands overseen by federal agencies, he feels, that could have dire consequences.

"For example," says Heissenbuttel, "let's say a court ruled that there could be no loss of any kind of any species in an area. But species fluctuate naturally. If the population dropped at all, entire habitats could be off-limits that weren't before."

While a Scheuer spokesman agrees that litigation would be possible after passage of the bill, he insists that there *would* be a legal clarification of biodiversity after a lengthy review process. Scheuer's office hopes the bill will be passed this year, so that work on the center can begin in 1990.

Heissenbuttel won't predict whether the bill, which has to pass through three committees before reaching the floor, will be passed into law. But, he laments, "Voting against biodiversity is like voting against mom or apple pie."

Scheuer is feeling particularly bullish about his bill since he became president of a new international group of legislators in April. Called GLOBE, and composed of members of various European parliaments, three U.S. senators, and three congressmen, the group will push for environmental reform around the world, including new environmental regulations in Europe. "We'll also be looking at the way Third World debt is connected to environmental devastation," Scheuer says. "And we'll try to get the Japanese involved."

But Scheuer and his cosponsors believe that the biodiversity bill is necessary to demonstrate the U.S.'s commitment to protecting the environment. "This bill will strengthen the hand of our negotiators overseas," says Congresswoman Schneider. Global environmental destruction, she says, "transcends traditional boundaries, ecology, and politics." Lovejoy, a big proponent of saving tropical rain forests, agrees. The biodiversity bill, he says: "is important not only because of what it does inside the U.S., but because it sets up an example to other countries. It's hard to exert moral sway in the world if we aren't trying harder in the U.S."

Bob Reiss writes frequently for LIM.

[Briefing]

BIOLOGICAL DIVERSITY IN HAWAII—PROTECTING OUR NATION'S UNIQUE BIOLOGICAL RESOURCES

JANUARY 11, 1989

State Capitol Auditorium, Honolulu, Hawaii

Panel 1

Mr. Kelvin Taketa, Vice President/Director of Resources, The Nature Conservancy

Panel 2

Mr. Al Marmelstein, Pacific Islands Administrator, U.S. Fish and Wildlife Service

Mr. Bryan Harry, Pacific Area Director, National Park Service

Mr. William Paty, Chairman, State of Hawaii, Department of Land and Natural Resources

Panel 3

Dr. Donald Duckworth, President and Director, Bernice P. Bishop Museum

Dr. Ken Kaneshiro, Director, Hawaii Evolutionary Biology Program, University of Hawaii

Dr. Cliff Smith, Director, Cooperative Park Studies Unit, University of Hawaii

Panel 4

Ms. Marie Morin, President, Hawaiian Audubon Society

Ms. Susan Miller, Representative, Natural Resources Defense Council

Ms. Marjorie Ziegler, Hawaii Chapter, Sierra Club

Mr. Rick Scudder, Chairman, Conservation Council for Hawaii

Congressman **Scheuer**. As some of you may know, Congressman Akaka and I introduced a bill in the last session of Congress on biological diversity. The bill is called the National Biological Diversity Conservation and Environmental Research Act. Its much too complicated a title for a very simple goal which is preserving the riches, the glories of the environment and the legacy which was given to us by our forefathers. And the goal is to engage in sustainable environmental and biological practices, to sustain a quality of life, our economy, our society and in a way that will not prevent future generations from inheriting a planet, a global village, which will have the same biological diversity which will enable them to achieve a sustainable management economy to preserve their quality of life and standard of living. There are a number of great goals to be achieved by conserving biological diversity, that assures future generations the full length and breadth of genetic and biological materials to meet future needs, whatever they may be. We can not anticipate them or project them at this time. We know that 40% of all the drugs that we enjoy to protect our health and society and well-being originate in plant life. And the greatest laboratories on Earth of plant life varieties are from tropical rainforests here in Hawaii, in Central America, Latin America, (the Amazon Basin), and other places around the world. I have a passing familiarity with those characteristics, but of course Congressman Akaka is the expert authority on biological diversity in Hawaii. I have talked to him enough to know that Hawaii is a basket case of mismanagement and neglect and that there is an urgent global need to protect biological diversity of this glorious, beautiful state. Hawaii covers 2/10 of 1% of the surface of the United States but 25% of all the endangered species in the entire United States and possessions occur in Hawaii. 2/10 of 1% of the land, 25% of all the endangered species. Of all the original ecosystems that were found on these islands, on this beautiful state when Captain Cook first landed here 210 years ago, half of them are threatened with extinction by the year 2000. If major intervention doesn't take place, then 72% of all the endangered species in all of the United States will be found in Hawaii, a state that has 2/10 of 1% of the population, 72% of all the species that face extinction by the end of the century, 25% of all endangered species and 72% of all those who face extinction by the year 2000 or about. And this sad prospect includes the fact that 90% of all the plants and birds on this island are to be found nowhere else. So when we destroy our biological diversity in Hawaii, we've destroyed the prospects of ever finding those plants and birdlife anywhere on the globe because they don't exist, 90% of them, anywhere outside the confines of this state. So this state is literally a treasure house for our country, our nation and the world. Any thinking human being has to feel that a major role of government has to be to abandon the long lasting style of passive benign neglect so to speak and get into the trenches to preserve this glorious heritage for the citizens of this state, for our country and for all mankind. Now at this point I would like to introduce Congressman Daniel Akaka, your very distinguished and highly respected Member of Congress, who enjoys the credibility and the deep respect from all points of the political spectrum in Washington. You are fortunate indeed to be represented by such a high caliber Congressman known for his excellence. I will introduce him now to make a few opening remarks and then to introduce the witnesses to whom we'll be asking questions. It gives me great pleasure to introduce your Congressman Daniel Akaka.

Congressman **Akaka**. Thank you very much, Mr. Chairman. I want to express my very, very deep appreciation to Congressman Jim Scheuer of New York, my colleague for being with us today. This is a sacrifice on his part as far as I'm concerned to spend time here in Hawaii and to have a briefing as we're having today. He is Chairman of the Science Space and Technology Committee's Subcommittee on Natural Resources Agriculture Research and Environment. There is no one in Congress who is more informed about the issue of preserving biological diversity than Congressman Jim Scheuer. He is our beacon as far as I'm concerned, our beacon in the darkness on this important subject. You heard him expound his feelings on biological diversity. He is quite well versed in this area and his intent is sure and it appears that the bill H.R. 4335, that we offered within the last Congress that we offered together, yes we're offering it together again as H.R. 1268. And I want to say at this point we both visited the Big Island yesterday, we were not able to see what we wanted to see entirely but Congressman Scheuer saw enough to whet his appetite, so that he has committed himself to coming back to Hawaii when the weather is a little better than it was yesterday, to see the preserves that we have on the Big Island. I also want to thank the witnesses who have agreed to present testimony at this Congressional briefing on preserving biological diversity in Hawaii. I feel you are all experts in your respective fields and we look forward to hearing from you. Today we will hear from witnesses representing major federal and state agencies with the responsibility of conservation and protection of biological resources, the kind of resource organizations that focus on identifying, cataloging, preserving Hawaii's biological diversity. Also environmental organizations that have championed the cause of preserving biological diversity. I am glad that we have so many players involved in this important movement. Given the size and the complexity of the task we have we need all the help that we can get. Congressman Scheuer's deep understanding prompted him to offer that bill H.R. 4335, the National Biological Diversity Conservation and Environmental Research Act (H.R. 1268 in the 101st Congress). The bill which would impose many landmark requirements designed to preserve biological diversity. Congressman Scheuer, the concerns addressed in your bill embrace a ton of life on our planet and it is that important to all of us. I am very glad to be a cosponsor of his bill and look forward to it being enacted into law. The day it reaches the President's desk and is signed into law cannot be too soon. I also want to offer special words of praise for The Nature Conservancy and its work here in Hawaii. Through the work of the Conservancy and its Hawaii heritage programs, the urgency of endangered species conservation has become more widely known. Through the leadership of the Conservancy, the preservation of endangered life forms is finally becoming one of the leading social, political and economic issues of our time. Recognition of this concern climaxed last week when TIME magazine took the bold step of naming the Endangered Earth and I quote as "Planet of the Year" in lieu of the traditional man of the year. As the rest of the nation begins to wake up to the issue of biological diversity, Hawaii is already off to a head start. Thanks to the efforts of the Nature Conservancy, the National Park Service here and our state organization and organizations like them. In the 9 years since the Hawaii chapter was founded, the Nature Conservancy of Hawaii has grown to over 7,000 members and raised millions of dollars for the protection of more than 40,000 acres of land—habitats which are critical to the survival of 14 of Hawaii's endangered species and thousands of other native plants and animals. For this we thank you and ask you to keep up the good work. I strongly support the legislation to establish national policies to conserve biological diversity. The need is urgent but without a national commitment we will remove some of the most precious and irreplaceable resources that our country and our world has to offer. Our unique heritage of plants, animals and other organisms that make possible much for all of the food, medicine, clean air, clean water, and countless other necessities that sustain our quality of life. An irreversible decline in biological diversity is now taking place. With each habitat that is destroyed and each species that becomes extinct, more biological diversity is going to be lost and we travel further and further down a one way path from which there is no return. Nowhere is the situation more desperate than in Hawaii. Hawaii is maybe the 50th state, but it is the first in terms of biological diversity. Our unique island is home to tens of thousands of species, found nowhere else on Earth. Many face extinction unless we act now to protect these species. Nature will not offer us a second chance. Although our state compromises less than .2% of the total land area of the United States, Hawaii is home to more than 25% of all our country's endangered and threatened plants and animals. It is a sad but sobering fact that Hawaiian species account for more than 20% of all recorded extinctions in the United States. Hawaii is also this country's primary tropical resource, plus it is one of the few locations in the United States where we have the opportunity to preserve tropical ecosystems. Because the majority of the world's species live in the tropics, Hawaii is a logical place to build practical research strategies and cost effective conservation methods that can be shared worldwide. Hawaii can serve as an evolutionary laboratory to further research on preserving biological diversity. The future loss of biological diversity will have profound consequences for the welfare of mankind. Only recently have we begun to truly appreciate the scope of this problem and its effect on nature's subtle machinery. What we now know should be sufficient to frighten each of us into realization that conservation of biological diversity is nothing short of an ecological imperative for man and his future here on Earth. Yesterday we had a rare occasion because we returned early from our trip to visit Hakalaua, Al Marmelstein delivered a briefing there that kept the people silent. I tell you after Al left the room I asked them, "Did you guys enjoy that?" They said, "Wow, that was great, I really enjoyed it." What Al did was tell a story about the moments of the history of Hawaii, when Hawaii had lost its environment and species because of change of environment and the coming of Europeans to Hawaii. But this morning we want to hear from you. We have testimony here. I want to tell you that we will place the totality of your testimonies in the record. You may precede as you like. We will try to keep you down to a limited time but I'll control that in case you need more time we will certainly let you have it. I thank you again for appearing this morning and we would like to hear first from The Nature Conservancy and the name I have here is Kelvin Taketa. So Kelvin will you please come forward—so that we may begin your testimony.

[The prepared opening statement of Mr. Akaka follows:]

THE HONORABLE DANIEL K. AKAKA

OPENING STATEMENT FOR THE CONGRESSIONAL BRIEFING ON

PRESERVING BIOLOGICAL DIVERSITY IN HAWAII

STATE CAPITOL AUDITORIUM

JANUARY 11, 1989

Let me first thank all the witnesses that have agreed to present testimony at this Congressional Briefing on Preserving Biological Diversity in Hawaii. You are all experts in your respective fields, and we look forward to hearing from you.

Today we will hear from witnesses representing: 1) major federal and state agencies with responsibility for conservation and protection of biological resources, 2) public and private research organizations that focus on identifying, cataloging and preserving Hawaii's biota, and 3) environmental organizations that have championed the cause of preserving biodiversity.

I am glad that we have so many players involved in this important movement. Given the size and the complexity of the task, we need all the help we can get.

Let me also express my deep appreciation to my colleague, Representative Jim Scheuer for being with us today. He is Chairman of the Science and Technology Subcommittee on Natural Resources, Agriculture Research and the Environment.

There is no one in Congress who is more informed about the issue of preserving biological diversity than Congressman Jim

Scheuer. He is our beacon in the darkness on this important subject.

Congressman Scheuer's deep understanding prompted him to sponsor H.R. 4335, the National Environmental Diversity Conservation and Environmental Research Act, a bill which would impose many landmark requirements designed to conserve biological diversity. Congressman Scheuer, the concerns addressed in your bill embrace the very foundation of life on our planet. I am happy to be a cosponsor of his bill, and look forward to it being enacted into law. The day it reaches the President's desk and is signed into law will be none too soon.

I also want to offer special words of praise for the Nature Conservancy and its work in Hawaii. Through the work of the Conservancy and its Hawaii Heritage Program, the urgent need for endangered species conservation has become more widely known.

Through the leadership of the Nature Conservancy, the preservation of endangered life forms is finally becoming one of the leading social, political and economic issues of our time. Recognition of this concern climaxed last week when TIME Magazine took the bold step of naming the "endangered Earth" as "Planet of the Year" in lieu of the traditional Man of the Year.

As the rest of the nation begins to "wake up" to the issue of biological diversity, Hawaii is already off to a head start, thanks to the efforts of the Nature Conservancy and other organizations like it. In the nine years since the Hawaii chapter was founded, The Nature Conservancy of Hawaii has grown to over 7,000 members and raised millions of dollars for the protection of more than 40,000 acres of land -- habitat critical to the survival of 14 of Hawaii's endangered forest bird species and thousands of other native plants and animals.

For this we thank you. Keep up the good work.

I strongly support legislation to establish national policies to conserve biological diversity. The need is urgent, for without an immediate, national commitment we will lose some of the most precious and irreplaceable resources our country and the world have to offer -- our unique heritage of plants, animals, and other organisms that make possible much or all of the food, medicine, clean air, clean water, and countless other necessities that sustain our quality of life.

An irreversible decline of biological diversity is now taking place. With each habitat that is destroyed and each species that becomes extinct, more biological diversity is forever lost and we travel further and further down a one-way path from which there is no return.

Nowhere is the situation more desperate than in Hawaii. Hawaii may be the 50th state, but it is the first in terms of biological diversity. Our unique islands are home to tens of thousands of species found nowhere else on earth. Many face certain extinction unless we act now to protect these species. Nature will not offer us a second chance.

Although our state comprises less than 0.2% of the total land area of the United States, Hawaii is home to more than 25% of our country's endangered and threatened plants and animals. It is a sad but sobering fact that Hawaiian species account for more than 70% of all recorded extinctions in the United States.

Hawaii is also this country's primary tropical resource. Thus, it is one of the few locations in the United States where we have the opportunity to preserve tropical ecosystems. And, because the vast majority of the world's biological diversity lies in the tropics, Hawaii is the logical place to develop practical research strategies and cost-effective conservation methods that can be shared worldwide. Hawaii can serve as an evolutionary laboratory to further research vital to our understanding of much of the world's remaining biodiversity.

The continued loss of biological diversity will have profound consequences for the welfare of mankind. Only recently have we begun to truly appreciate the scope of this problem and its effect on nature's subtle machinery. What we now know should be sufficient to frighten each of us into the realization that conserving biological diversity is nothing short of an ecological imperative for man and his future here on earth.

Thank you.

Kelvin Taketa from The Nature Conservancy. I want to thank you Congressman Akaka and Congressman Scheuer for this opportunity to express our support on behalf of H.R. 4335 and to thank both of you for your recognition of the special role Hawaii plays in preserving our nation's biological diversity. It's a real rare privilege for all of us here today who have been working so hard on behalf of biological diversity protection in Hawaii to, in a sense, get an opportunity to preach to the converted. Congressman Scheuer in his remarks and you in your remarks have virtually taken the best out of my whole speech so I'll try to keep it short and we'll move ahead. Certainly America faces a growing challenge in conserving biological diversity and Hawaii is a top priority.

The Nature Conservancy is the largest non-profit land conservation organization in the country and our sole mission is to identify and protect the world's best remaining natural areas from extinction of biological diversity. To this end The Nature Conservancy has protected over 3 million acres in the United States, Canada, Latin America and the Caribbean. In 1986 the National Board of Governors of the Nation Conservancy declared Hawaii the organization's top domestic priority. Since then the Conservancy has been mustering project resources nationwide to help stem the tide of Hawaiian extinctions. To date the Conservancy has protected over 42,000 acres in Hawaii and currently manages over 15,000 acres in 8 foreign reserves. We fully recognize that these are just the first critical steps on a long road towards ecological stability.

With your permission I'd like to show you a few slides that will illustrate for us current conservation status. Over 90% of Hawaii native species can be found nowhere else on Earth. Hawaii's astonishing diversity is the product of millions of years of isolation, in the middle of the world's greatest ocean. Before man's arrival, colonization by plants and animals was extremely slow, with perhaps one new plant species becoming established every 100,000 years. Many kinds of plants and animals could not have reached Hawaii without man's help. We have only two native land mammals, both bats, no native reptiles and amphibians. For those species to have survived the crossing of 2,000 miles of salt water from lush rainforests to lava fields and from frozen summits to sand dunes.

No place on Earth offers more splendid examples of evolution. From a single colonizing fish that may have looked like this, over 50 kinds of Hawaii land creatures evolved. These animals may have given rise to over 1,000 new species on the island. In undisturbed native habitats this incredible process of speciation continues today further enriching the biological diversity of the Earth.

The good news is that a quarter of our state still retains relatively intact natural communities of native organisms. But the influences of man, especially in the form of non-native species is spreading rapidly. Only two small peaks remain free from the ravages of introduced pigs or other foreign animals which have flourished on the land free of their natural predators. If left unchecked these pests destroy native vegetation and the native animals that depend on it. The diverse ecosystem becomes a homogenized weed patch with few plants or worse a desert.

As H.R. 4335 points out, the loss of biological diversity is a costly irreversible process that seriously compromises the quality of life we pass onto our descendents. In Hawaii, native forests make up the core of our primary watershed areas on every major island. The genetic value of only a few species have been assessed but these few have yielded incredible results. For example, the Hawaiian cotton, the native of dry lowlands has been bred as commercial cotton to produce a strain that is less attractive to ants and other insects greatly reducing the level of pesticides needed to protect commercial cotton products. This unimpressive soft cotton is found only in Hawaii. It produces an important anti-tumor compound. Less than 10% of the Hawaiian forest has been surveyed for useful chemical compounds.

Hawaii's biological diversity also has cultural and aesthetic values. Hawaii's cultural traditions are closely linked to native species and the natural phenomena of our native ecosystems. Hawaii's natural beauty and the model climate continue to be the foundation of our tourist industry and pleasant life-style.

To reverse the trend of species loss and to maintain the health and function of native ecosystems, a national commitment to the preservation of biological diversity is urgently needed. The endangered species act alone cannot do the job. The endangered species act has given to our society a way to provide intensive care to a species on the brink of extinction. But in addition to this biological brinksmanship we must maintain the health of full ecosystems which can sustain thousands of species at little cost to man. This is the wiser, more economical preventive medicine which keeps species away from the brink.

The national policy of conservation of biological diversity will build this strategy of ecosystem health into our social consciousness. The bill would support the cooperation of the information needed to set conservation priorities and guide natural resources management. Linked to a nationwide database system, the Hawaii system currently contains information on the location and the status of about 40% of Hawaii's rare biological elements. This information represents the cumulative work of scientists and naturalists and is used as a public information source to enhance conservation and land use planning. A federal commitment to biological diversity and conservation could speed the accumulation of data of the remaining species and communities to support vital work at the Bishop Museum, the University of Hawaii, and other institutions to fill critical information gaps.

Acquisition of key natural habitats has been the leading conservation tool of Hawaii. According to the Hawaii heritage program data base, the current system of federal parks, refuges, state natural land reserves, and sanctuaries and private nature reserves contains examples of about 70% of Hawaii's native natural communities and ecosystems. But nearly 30% of Hawaii's native natural communities types are not represented in these reserve systems. And it is not possible to estimate at this time the percentage of native species occurring within the system. Additional land acquisition is needed to protect key habitats and to improve the viability of existing reserves. The federal government has been an essential partner in this acquisition process. Further participation by the federal government is needed to meet the minimum preservation goals. Equally important, evidence clearly shows that no natural area in Hawaii is secure against disturbance without direct and innovative management primarily due to the impacts of non-native species. Nearly half of all funds raised by the Conservancy are being applied to preserve stewardship and we still have much more to do. The National Park Service leads the way in testing and other efforts to maintain and restore native habitats. And the Governor has provided initial funding to bring stewardship and we still have much more to do. The National Park Service leads the way in intensity and other efforts to maintain and restore native habitats. And the Governor has provided initial funding to bring an active stewardship program to focus on the state's natural land reserves. The size of the stewardship task can not be overestimated and increased federal support which would be provided under this bill is needed. As you have learned from previous hearings on this bill, basic technological research is also needed if we are to effectively conserve our nation's biological diversity. We must know more about the basic life histories of the species we are conserving before we can adequately address the forces that threaten them. The research programs of the Park Service and Fish and Wildlife Service represent the bulk of Hawaiian work to date and all of us in the conservation business rely heavily on those programs. But these federal programs need consistent and long term federal support and additional research must be done. Through a $500,000 grant from the Carnegie Foundation, the Nature Conservancy has organized a Hawaii conservation biology initiative to help organize inter-agency research priorities and enhance available research support. The national policy for the preservation of biological diversity would provide the catalyst for growing research programs. Mr. Chairman, Hawaii's long epitomized the island paradise for the rest of the world. The loss of biological diversity is mostly rapidly underway on islands, whether they be natural lands, like islands like Hawaii with unique species vulnerable to changes brought upon by man or manmade islands of habitat where the larger natural landscape has been fragmented or destroyed. Hawaii conservation is a global priority because of the thousands of species that occur only here. But in addressing Hawaii's conservation challenges, America can also lead the way for world conservation efforts. Our Hawaiian experience can show us how to help other Pacific islands before they lose more of their endangered species. And a program that succeeds to maintain a native habitat in Hawaii can serve as a model for managing a tropical rainforest in Brazil. The Nature Conservancy and other representatives of conservation here today are dedicated to this mission. We support your efforts to make the conservation of biological diversity a national priority and are grateful for your leadership. Thank you.

CHAIRMAN. We do have some questions for Mr. Taketa. Let me ask the first question and that question is: What can you say about working relationships among the different groups? There are several levels of government, local, state, federal.

Mr. TAKETA. To answer your question Congressman, I think that the working relationship between the organizations that are here in Hawaii have been very good. I can't say enough for I think that the new administration and the state government and the leadership that they are providing for conservation have added a lot of momentum regarding biological diversity. And I think that is a step in a positive direction.

I think it is important that we avoid the duplication and that we try our best to coordinate the efforts of these groups to best take advantage of the scarce amount of resources we have both in terms of money and human resources. I think primarily that this requires a strong commitment on the part of all the agencies and organizations towards communicating with one another and to engage in a pretty frank assessment of what unique strengths and attributes we can bring to bear in terms of the whole spectrum of conservation strategies. So that we don't duplicate or there is no redundancy in the kind of efforts that we employ.

The final thing would be is that it would be helpful to have evaluations, and I know the state is looking at this now, to make sure that we can eliminate any administrative or statutory obstacles that would prevent the agencies from working together. In many instances, for example, on Molokai there is a national park which is adjacent to a state natural land reserve which is adjacent to a Nature Conservancy refuge. Our abilities to avoid one chief going up the hill while the other chief is coming down really would be helpful. And to the extent that we can all plan and implement funding together, we would attack the stewardship problems. This would be the way to go.

CHAIRMAN. So you would agree that there is a formidable effort to coordinate among the various groups?

Mr. TAKETA. Yes, it's growing and it's getting better.

CHAIRMAN. Is there a statewide biodiversity conservation plan?

Mr. TAKETA. There is no plan at this time. In fact it is something that has been discussed in the past. I think that the efforts were made by various agencies to try to demonstrate the state of biological diversity and what was to be accomplished, but there is no state coordinated plan.

CHAIRMAN. You also mentioned that you want to avoid duplication. Do you have any idea how we can avoid the duplication?

Mr. TAKETA. I think we're on the right track. All of the groups seem to have very good coordination and our ability to work together has been to our advantage. I think that there is growing coordination among the federal agencies. I think that there is growing coordination among the federal and state agencies. I'm not sure whether a formal plan is really necessary.

CHAIRMAN. I want to thank the gentleman for his outstanding fine statement and also to thank him for the terrific work he has made while with The Nature Conservancy. We'd all be much worse off without your marvelous contribution.

Mr. TAKETA. I thank you Congressman.

Congressman AKAKA. In your testimony you mentioned current problems we face, can you in a few words mention what the critical needs for Hawaii in particular.

Mr. TAKETA. At a federal level, the efforts that you and your fellow Congressmen have made to increase funding to Hawaii for the acquisition of refuges and parks have been exemplary. We need to continue that momentum and to continue the race to get the funds necessary to protect all the remaining ecosystems that as of yet are not protected. But at the same time, I think we need to look at how to increase management funds. The parks and refuges really have been suffering from limited amounts of funding for operations and maintenance. To the extent that we can increase funds for these areas, I think that is one that we call all work towards. This state as I've said is already involved in land programs. I think that any funds that could be made available through the federal government whether it be through this H.R. 4335 or through the American Heritage Trust Act which has a great deal of matching funds components as it centers for state government would be very, very helpful. I also think that to the extent that we can continue to support federal research activities out here in both the Fish and Wildlife Service and The National Park Service, that will again play a major role. It's difficult at best to be able to attract private reserach opportunities to a place like Hawaii even though everyone recognizes the importance Hawaii plays as an outdoor lab for evolutionary biology. This is something we haven't been able to do successfully yet through a lot of private efforts and I think having the federal government supporting ecological research programs is critical.

Congressman AKAKA. What kind of management, reforms or improvement by the various agencies of government should be enhanced to improve biological diversity?

Mr. TAKETA. Certainly in your legislation you call for review of certain federal projects that have biological diversity considerations and I think that is a very positive step in the right direction. In addition to that, when it comes to the lands under the jurisdiction of the federal government I believe that the professionals here in Hawaii which has been the basis of my experience are all very, very good. The primary problem has been being able to increase funding levels so that they can take on some of the greater management problems. You've done a terrific job by supporting things like the Hawaii Volcanoes National Park where significant funds were appropriated so that they could tackle some of the major problems and lower the goat population that was destroying much of the biodiversity that existed in the park. We need to beef up those programs. The primary thing, I think, finding funding at this point is the most important thing.

Congressman Akaka. What would be required to do a reasonable job of enhancing and ensuring biological diversity in those lands that are already owned by the federal government?

Mr. Taketa. That's somewhat difficult for me to say because I am not that familiar with some of the management programs that for example, Brian Harry would like to see occur. But I can tell you that I think that based on funding for management, this is a critical part. Both the Fish and Wildlife Service and the Park Service have research programs that are part of their overall resource management programs; those are real critical for the success, because so much of what we are doing out here, Congressman, as I mentioned in my remarks, is cutting-edge. There are no other places in the United States where we can really in a sense put our money where our mouth is as we begin to discuss, for example, the reduction of third world debt in exchange for conservation programs in Brazil and other Latin America countries. One of the things I've found in my discussions with those countries is that they've said, "Well, gee, there is an existing tropical forest in the United States; it's found in Hawaii and what is the United States doing about it before they come telling us what to do, what are you going to do about your own tropical forest? And I think we are taking a step in the right direction but we're having to learn as we go. As someone once said it's kind of like building an airplane while flying. Well, to a certain degree that is what we are doing. It can't be helped. The urgency in trying to protect the resources out here requires us to build an airplane and fly at the same time. But it also requires us to have the kind of funding necessary to really attack these problems and make some dents so that we will all be able to learn from them. I think that your remarks and the other Congressman's remarks about the The Nature Conservancy obviously make me feel very proud but we have not done this alone, for example, the Audubon Society, the Sierra Club here in Hawaii were very instrumental.

Congressman Akaka. We're all in this together. We'll either hang together or separately. Every one of these groups, non-profit and government, play a role together in the case where the whole is the greater than the sum of the parts.

Mr. Taketa. And I think that there is a fairly well coordinated strategy for this in Hawaii right now in terms of what we are all trying to do. But again if I could point to anything, I think that your bill, the bill to establish this policy and implement programs which would bring funding along with it will make a tremendous impact on conservation in Hawaii. And I think, like the endangered species act did in establishing a frame of reference in the American public about endangered species, the biodiversity bill has the same capability of creating that framework in their minds about biodiversity. Time magazine, Good Morning America is going to be out here next week talking to people about what is happening here. National Geographic dedicated their centennial issue to the state of the Earth and talk about the protection of biological diversity. The United States is one of the fortunate countries that can lead the way on a particular bill.

Congressman Scheuer. If the witness will yield? Can you very appropriately remark and give some specific examples as to how far the people are ahead of the government. This whole issue of Time magazine, as you pointed out, is dedicated to the Earth this year, the "man of the year" is the Earth, this year. As Time is not an advant garde, a way-out ultra-liberal organization, it's very centrist; it represents the mainstream of America and when they devote a whole issue to the globe, the Planet of the Year rather than the man of the year, you got to assume that something has happened to the consciousness of the American people, because Time doesn't lead, they generally reflect. US News and World Report has on the front cover of this issue the globe. So here you have a case where the media are reflecting. How far ahead of government has the media raised the people's consciousness? And government should be responding to the people. Government doesn't have to lead they just have to follow what the people want. Every poll in the last decade, when people are asked do you want to protect the environment, do you want to protect safe water, do you want to enhance biodiversity; they say without exception, yes we do. They may want to cut some programs they consider wasteful and stupid but in terms of preserving the planet the people are 100% for it and they are way ahead of their government officials. And what Congressman Akaka and I plan to do is lead the Congress in a game of catch up ball. We're trying to get the government to catch up to the sense of priority and the heightened sense of consciousness of the American people is absolutely right there and you and your organization are in the lead.

Al Marmelstein of the Fish and Wildlife Service, Bryan Harry of the National Park Service and Bill Paty from Natural Resources. Gentlemen, your testimony will be placed in the record in its entirety and you may proceed.

ALLAN MARMELSTEIN. Mr. Akaka, Mr. Scheuer, my name is Alan Marmelstein. I am the Pacific island administrator for the Fish and Wildlife Service and these are my colleagues. I will make the first statement. I truly appreciate the opportunity you have provided me as representative of the Fish and Wildlife Service, to be here this morning. As both of you have eloquently stated, the Hawaiian islands are really a unique spot on the Earth with respect to both biological diversity and the opportunities for demonstrating that biological diversity can be conserved. As you also indicated, the islands are unique in another status that we are not as proud of and that is that they represent a major center for current endangered species and for entire extinction in the United States. The Hawaiian islands have a unique status both in respect to biological diversity and as a center for endangered species occurrences in the United States. That offers us both something to be not proud of and an opportunity as well because it has allowed us under current authorities that the Fish and Wildlife Service and other federal agencies operate under to take some action in the preservation of biological diversity in the island, because activities which promote the preservation of currently endangered species because of the unique nature of the problem in Hawaii also allows us to make some efforts in preserving biological diversity. In the interest of brevity, I will give you just two examples of where the Fish and Wilflife Service has current authorities to do that. One, is the Fish and Wildlife Coordination Act which is the legislation, as you know, which allows us to interact with other federal agencies and their various roles as it affects the environment. Using that authority and working with the Corps of Engineers and permit reviews we have had several opportunities to take advantage of preservation of biological diversity. One that I can give you just a brief summation of was an event that occurred several years ago, a major resort development on the island of Hawaii where we used our authority under the Fish and Wildlife Coordination Act working with the Corps of Engineers, EPA and Natural Marine Fisheries Service to see to, and I might add with a lot of support from the environmental community in Hawaii without which it wouldn't have happened, to set aside a pond area, that was going to be destroyed by this hotel development, that is a unique environment in Hawaii and like most unique environments in Hawaii it also contains unique organisms. We were able to have 14 acres of those ponds set aside to establish a trust fund which will allow the University of Hawaii to continue to learn more about how those ecosystems function and to manage them well into the future. So as an example, the Fish and Wildlife Coordination Act allows us to do that kind of thing in Hawaii.

Another example of that would be the authority under the Endangered Species Act which allows us to acquire lands for preservation, and as you are well aware as the sponsor of the appropriations yourself and Mr. Inouye we have been active over the last several years establishing Hakalau Forest National Wildlife Refuge which unfortunately, we didn't get into. That is what we were trying to get into yesterday before we got rained out. In setting that aside, the authority for that is the protection of four or five species of endangered forest birds. In order to protect them we need to set aside a fairly large tract of native forest and that gives us the opportunity to also protect all of the plants and insects and other organisms that occur within that forest. So that is another example of where current authority, the endangered species act does allow us to make some strides in the direction of the preservation of biological diversity. In the interest of being brief this morning I think I'll conclude my comments there and when my fellow panelists are through I will be available for any questions you wish to ask.

[The prepared statement of Mr. Marmelstein follows:]

BRIEFING FOR CONGRESSMEN JAMES SCHEUER AND DANIEL AKAKA ON PROTECTION OF BIOLOGICAL DIVERSITY IN THE HAWAIIAN ISLANDS

January 11, 1989, Honolulu, Hawaii

I am Allan Marmelstein, Pacific Islands Administrator for the U.S. Fish and Wildlife Service. I appreciate the opportunity to meet with you today to discuss the activities of the Service to protect the biological diversity of the Hawaiian Islands.

As you are aware, the Hawaiian Islands are unique in the diversity of animal and plant species native to the area, and in the fact that the majority of these species do not occur anywhere else in the world. For this reason, we of the Fish and Wildlife Service are disturbed by the current decline of animal and plant species and are utilizing existing authorities, such as the Endangered Species Act and the Fish and Wildlife Coordination Act, to reverse this trend. To date, many of these imperiled species have been listed as endangered or threatened and many more are candidates for listing. For us, the issue of endangered species and biological diversity are inextricably intertwined.

A couple of recent examples of how these existing authorities have been used to protect biological diversity might help illustrate my point. In 1984, the Service, under authority of the Coordination Act, was involved in reviewing an Army Corps of Engineers permit that involved dredging and filling a type of coastal ponds which are only known to occur in a few places outside of Hawaii. As with most other Hawaiian environments, these ponds contain several species found nowhere else in the world.

Even though the dollar value of this land is set by the square inch, we were successful, with the support of the Corps and other involved Federal agencies, in setting aside approximately 14 acres of these ponds. In addition, we established a trust fund which will allow researchers from the University of Hawaii to manage and monitor the status of the ponds and their unique inhabitants well into the next century. The ponds themselves have been protected in perpetuity as a condition of the Corps permit.

At about the same time, an area on the Island of Hawaii was identified as central to the survival and recovery of four species of endangered Hawaiian forest birds. These birds are dependent on native forest for their continued existence. By establishing the 30,000-acre Hakalau Forest National Wildlife refuge, the Service will be in a position to manage this wet-to-mesic rain forest habitat, not only for the four endangered forest birds but for the diverse community of other native forest birds, insects, and plants which compose this complex forest ecosystem.

In this manner the Endangered Species Act has been used not only to protect endangered species, but to provide umbrella protection to a significant representation of the biological diversity of a Hawaiian rainforest.

Thank y [illegible] the opportunity to present the Fish and Wildlife Service's perspective.

Bryan Harry. Thank you Al. Congressman Scheuer, Congressman Akaka, it's a pleasure to be here. I'm Bryan Harry and I am the Pacific area director for the Natonal Park Service. I might just briefly run down those parks. They extend from here to Samoa to Guam and Saipan and I'd like to include those islands because they have voting representatives as well. Of the ten parks that we have out here, four of them clearly have enormous biological resources, including Haleakala and Hawaii Volcanoes in Hawaii. They are both international biosphere reserves. They have been recognized world-wide as having outstanding Hawaiian ecosystems. Another park that's new, it has not set up yet, is the American Samoa National Park and its entirely a rain forest national park with an enormous ecosystem that differs in many ways from Hawaii and that is perhaps the nicest rain forest that the United States administers. Another park, the Alakai Swamp is one of the nicest aquatic habitats in the state of Hawaii. In all of these, a major responsbility that we have is to care for the biological resources of those forests. We have roughly for the ten parks of the Pacific, with $4.5 million operating expenses. I would say, on the top of that we spend 8/10 of a million dollars for biotic resources, to care for them in the forest parks that I understand.

I'd like to mention another park, it's a historical park that once had an island endemic biota, that's Hawaiian Pacific Historic Park in Guam and I mention that as a caution to what can happen to these natural places. I've been in this country about 18 years and since the time that I have been here, in the Pacific Park we have lost virtually the entire native vertebrae biota. It is incredible to be a steward of a park that disappears before your eyes. It disappeared because of alien vertebrate that came in here, the brown tree snake, and decimated the population. And I mention this because Hawaii and certainly Samoa are on the threshold of this type of happening. And if one isn't ahead and constantly monitoring and researching the resources you have, it disappears before you know exactly what you actually have. In fact, in the war in the Pacific we lost the resource of the park before we knew what it was.

Another thing that I would like to contribute and particularly as it relates to Haleakala and Hawaii Volcanoes parks is that we've had some enormous successes. You hear that it is impossible to do things with a biota that is destined to disappear, that really is not so. I think that in both of those parks you can see enormous accomplishments—the return of the forest in Hawaii Volcanoes Park, the salvage of the valley in the Haleakala park. There has been a lot of work by many, many people, the fine people on the park staffs there, but also volunteers on this island who buy their own plane tickets to go to Maui to work in that rain forest. And the lands that have been purchased by The Nature Conservancy and given to the National Park Service to protect that rain forest. So even, though the brown tree snake is there in Guam, I'd like to leave on an optimistic note that there is much that can be done. Thank you.

Bill Paty. Congressman Scheuer, Congressman Akaka, my name is Bill Paty and I'm the chairperson of the State Department of Land and Natural Resources. We are privileged to be here this morning because we have a very genuine and on going interest in this because this is our state and we are looking to be lead partners in preservation of our natural resources and in particular, our biological diversity. I want to, if I can, just walk through some of the things the state is trying to do in cooperation with the Fish and Wildlife Service and the National Park Service and with the Nature Conservancy and all the other groups this year. We are as you said Congressman Scheuer one team and we feel very much a one team program here, not that it is totally coordinated. We'd like to see it, but nonetheless I think in recent times we feel a common cause in what we are trying to do.

With respect to the state, the Hawaii state plan, in addition, to calling for an environment characterized by physical beauty and cleanliness and quiet, supports a stable natural system. So we can't solve the goal right there, the stable natural system. Under this I feel the most significant effort we have under way is our natural area reserve system. We have 18 of these for the specific purpose of protecting the remaining pieces of Hawaii's unique natural environment. Two basic missions of the program are to increase the ecological diversity and the reserve system by the addition of new reserves and to manage the reserves to prevent further deterioration and to preserve the quality of natural ecosystems as much as possible.

The administration has made a very substantial move in funding the reserve system. We are looking even to further monies in this upcoming year and we've been pleased with the strong work that we have been able to accomplish jointly using the resources of The Nature Conservancy people and an army of volunteer people who make a lot of it possible. We oversee 18 reserves that cover 108,288 acres. The natural land reserve commission itself has 2 or 3 reserves that are areas that we may be recommending shall be included in the reserve system of the state.

The state has also developed an endangered species plan, the Division of Forestry and Wildlife recently published the "threatened and endangered species plan for wildlife plant and invertebrates," commonly referred to as the "T and E plan." The plan is basic policy to implement the endangered species legislation of Hawaii statutes of 1950. It delineates the scope, authority, roles, responsibility, program, action plans and workload analysis for implementing various actions for this. In accordance with T and E plans, ten plant sanctuaries have been designated. New plants in the new plant sanctuary rule will soon be ready for public hearings. These plant sanctuaries, usually limited in size to less than 50 acres, often occur outside protective forest reserves, natural areas and conservation districts. Six are on state land, two on private land, two on the Hawaiian homeland. These sanctuaries protect rare, endangered, or threatened plants often located in disturbed sites where there are specific known threats to plants. The Forestry and Wildlife Districts has targeted 22 rare and endangered plants for the next 6 years which need protection and management.

Then we have a wildlife plan; included in this plan is a statement to perpetuate and increase non-game and threatened wildlife species for their intrinsic recreational, scientific and educational values. We're conducting surveys to determine baseline information, and operating the state captive propagation facility in Maui. We just had the successful propagation of the bird Alala, the Hawaiian crow up there, the endangered species lab up there and also the native bird habitat protection system which will help eliminate sheep and goats on Mauna Kea. Wildlife operations such as the successful new shear water program on Kauai established in sanctuaries like Hakalau Wildlife Sanctuary on the Big Island for forest birds including the endangered Alala. These are just some of the things that we're undertaking in recognition of the special role and the unique opportunity we have here. We are working as closely as we can with all the other agencies that have the same common cause as mine. Thank you, Mr. Chairman.

[The prepared statement of Mr. Paty follows:]

CONGRESSIONAL BRIEFING - BIOLOGICAL DIVERSITY AT THE HAWAII STATE CAPITOL

Representative James H. Scheuer, New York
Representative Daniel Akaka, Hawaii

By W.W. PATY

Congressmen Scheuer and Akaka, on behalf of the Governor and the people of Hawaii, I want to express our heartfelt appreciation for conducting this briefing session on "biological diversity" here in Hawaii. Our island community certainly is an appropriate setting for discussion of this all-important subject.

Consider that Hawaii has developed an interesting natural history since the very beginning of its existence. Its isolation from larger land masses prevented its colonization by life forms familiar to those continents. Instead, it took millions of years for various plants and animals to reach our shores and begin to occupy various niches unique to the Hawaiian Island(s) ecosystem.

From a few colonizing species, several plants and animals have evolved to provide us with an interesting array of native flora and fauna. Hawaii's natural ecosystems, with more than 90% of their indigenous plants and animals found nowhere else in the world, are a special resource with special values. They provide educational and scientific opportunities that are unique to our island state. They serve as an index of environmental quality. Because of the richness in their biological diversity, they serve as a valuable gene and chemical resource for the development and improvement of pharmaceutical and agricultural products. Our natural ecosystems are a natural heritage that once lost will be gone forever.

The unique and sensitive nature of native flora and fauna of Hawaii is thoroughly documented. Of approximately 2,400 different kinds of native plants, half have been proposed as threatened or endangered and 273 are probably extinct. Of the 70 birds and one mammal species native to Hawaii, 24 bird species have become extinct and 30 bird and one mammal species are now threatened or endangered with extinction. Land use changes and exotic plants and animals cause the major problems effecting native species.

In Hawaii, the problem of protecting native species is complex because most native species lack strong natural defense mechanisms. Most native plants are easily damaged by feral animals and do not compete well with introduced, aggressive plants. Because of their limited range, the native flora and fauna are particularly sensitive to human disturbances and to alteration of specialized habitat niches. These native areas also provide needed watershed and as mentioned previously, the plants serve as an important genetic resource.

In recognition of the important values that natural ecosystems impart to our island community and perceived threats to their continued existence, the State has embarked on several initiatives. Some of the more notable activities and/or accomplishments worth mentioning are as follows:

1) Hawaii State Plan

Adoption of the Hawaii State Plan by the legislative and executive bodies which include a goal for "...A desired physical environment, characterized by beauty, cleanliness, quiet, stable natural systems, and uniqueness, that embraces the mental and physical well being of the people."

This specific goal provides the State with definitive, and long-range direction regarding the perpetuity of Hawaii's unique ecosystems.

2) Natural Area Reserves System

The Hawaii Natural Area Reserves System Program has the specific purpose of protecting and preserving remaining samples of Hawaii's unique natural environment. Two basic missions of the program are to increase ecological diversity in the reserve system by the addition of new reserves and to manage the reserves so as to prevent further deterioration and restore natural ecosystem quality as much as possible.

The reserve system currently consists of 18 reserves with a total of 108,288 acres. Program functions include resource, inventories, monitoring of the resources, developing and implementing short and long-term management plans, establishing new reserves and developing public education and volunteer support.

3) Threatened and Endangered Species Plan

The State of Hawaii has 19 listed endangered plant taxa. Three of these have critical habitats defined. In addition, there are 767 plant taxa in our State under review for listing as threatened or endangered taxa (Federal Register, September 27, 1985).

The State Division of Forestry and Wildlife, Department of Land and Natural Resources, recently published the "Threatened and Endangered Species Plan for Wildlife, Plants and Invertebrates" (commonly referred to as the T&E Plan). This plan is a basic policy and planning document for implementing endangered species legislation (HRS 195D). It delineates scope, authorities, roles, responsibilities, program and action plans, and a workload analysis for implementing various actions. Six problem areas are defined with goals, objectives and targets defined for resolving them.

Under State law the Department of Land and Natural Resources is authorized to protect and manage all listed threatened and endangered species on all lands, federal, private, county, and state. In accordance with this law and the T&E Plan, 10 plant sanctuaries have been designated in a new plant sanctuary rule ready for public hearings. These plant sanctuaries, usually limited in size to less than 50 acres, often occur outside protected forest reserves, natural areas, and conservation districts. Six are on state land, two on private land, and two on Hawaiian Homes land. These sanctuaries protect remnant rare, endangered, or threatened plants often located in disturbed sites where there are specific known threats to the plants.

Forestry and Wildlife Districts have targeted 22 rare and endangered plant taxa for the next six years which need protection and management outside designated forest reserves and natural areas. T&E Program activities include fencing, fire breaks, planting, botanical survey and census, cooperative agreements with land owners, fire protection, recovery plants, and research.

4) Hawaii Wildlife Plan

Included in this plan is a mission statement to ..."perpetuate and increase non-game and threatened and endangered wildlife species for their intrinsic, recreational, scientific, and educational values."

Program priorities for this program area have been:

a) Conduct forest bird surveys to develop baseline information for resource management planning.

b) Operate and improve the State's captive propagation facility at Olinda, Maui. To date, we have been successful in "hatching out" a single Hawaiian endangered crow, the 'Alala and now look forward to many more propagation breakthroughs for other species as well, including Hawaii's State bird, the Hawaiian Goose or Nene.

c) Endangered forest bird habitat protection such as the elimination of sheep and goats on Mauna Kea.

d) Wildlife salvage operations like the successful Newell Shearwater program on Kauai.

e) Establishment of sanctuaries such as the Puu Waa Waa wildlife sanctuary on Hawaii for forest birds, including the endangered 'Alala.

I hope that my presentation has enlightened you in the uniqueness of Hawaii's native ecosystem and our efforts to preserve them in perpetuity. We have long realized that this effort is not an easy one in light of "pressures" on the environment and limited availability of financial and personnel resources. However, I take this opportunity to reaffirm the State's commitment to keep our ecosystem(s) as "biologically diverse" as possible.

If biological diversity is the measure of our environmental health, we must all work together to guarantee its perpetuity. To ignore and neglect its usefulness would be detrimental to the world community's life support system.

Congressman **Akaka**. Thank you sir. There was an article in the New York Times concerning how exotic plants and animals are destroying the Hawaiian environment. For the record, could you please tell us what work is being done and how valuable this appropriation to address the problem will be to preserve habitats at this point?

Mr. **Paty**. The money involved for the pig work which was largely research money, enables us to discover how to fence units and entirely remove pig populations from within those exclosures. As a result of that, we have been able to go to Upper Kipahulu valley a remote area in Maui rain forest and commence a program to keep pigs from decimating that forest. I think that directly that will be instrumental in saving such species in that forest as say, the crested and honeycreeper, but that is really only the tip fo the iceberg. Endangered species are like the canary in the coal mine, they represent the entire ecosystem of species and I honestly say to you sir, that without the work on the pigs we would have lost the rainforest, we would have lost the remnants of the rainforest and volcano forest that now is saved.

Congressman **Akaka**. Thank you, the next question is to Al Marmelstein. This has to do with a project that we were able to appropriate about $3 million to acquire. Could you give us the status of you agency's negotiations to acquire critical spots.

Mr. **Al Marmelstein**. Yes, Mr. Akaka, I would be pleased to. As a matter of fact, this morning within a few hours, a member of our realty staff in Portland who came in last night and some of my staff will be sitting down with folks from Campbell Estate and beginning to seriously negotiate about how we are going to consummate that acquisition this year. So we are actively pursuing that acquistion at this moment. With respect to the Walton's forest project we are somewhat earlier in the process on that project. As you know Campbell is a refuge that has been established for a number of years under lease and so we have a head start in that activity. We are, at the moment, finishing up the initial planning, documentation that we are requried to do under the national environmental policy act and other regulations within the department for defining boundaries and otherwise keeping them frugal for the inclusion of parks in the National Wildlife Refuge system. In conclusion we are actively pursuing both of those at the moment.

Congressman **Akaka**. Can you give us an idea about the cooperation among the state and federal agencies on the issue of coordination?

Al Marmelstein. I'd be happy to, my colleagues may also want to address that. I'd have to say that the level of cooperation between the Park Service and the Fish and Wildlife Service and the Department of Lands and Natural Resources, which is the state agency, in a word is excellent and is as fine as I've seen. As an example of that, you were asking Mr. Harry earlier about the research on pigs that was funded through a specific appropriation that you were able to get. I'd like to point out that the research the Park Service has done on controlling pigs is going to be central to protecting Hakaeau Forest National Wildlife Refuge and the other forest refuges that we have identified for acquisition and in fact the same individuals that have done that research for the Park Service have already been into Hakaeau and begun to apply that research for us. They've done the initial surveys: transects at the terminus where we have the most serious problems with pigs have laid out plans as to how we should approach the same sort of management that is going on in the national parks. I think that is a fine example of how the two services work together. There are many examples of that and the same may be said about the working relationship between ourselves and the Department of Land and Natural Resources and I could give many similar examples there.

Congressman **Akaka**. What kind of priorities is the struggle to preserve biological diversity given the mandate of the National Park Service?

Mr. **Paty**. I think that in the national mandate of the National Park Service, Hawaii is peculiar. We're used to putting a title on land saying National Park and therefore everything must be OK, and in Hawaii that isn't the case; you really have to dig in and manage. So it is peculiar to our bureau. It is also a long ways away: as a bureau we are probably more comfortable with maple forests than we are with ohia and koa. Still we feel that nationwide we are given a lot of support here. They kind of look at us peculiarly but the National Park Service takes pride in the work that is going on here in Hawaii.

Congressman **Akaka**. Let me ask Mr. Paty about the status of purchasing of critical habitats by the federal government from the state.

Mr. **Paty**. We have under consideration some areas that might be made available by purchase. However, we have a number of areas that we think could serve the same purpose by just declaring them and managing them properly ourselves. I would say the bulk of our funding goes into trying to secure special shoreline areas for recreational purposes, but in a number of areas I think we are going to try to combine goals where we can secure a wildlife sanctuary while at the same time provide something in terms of recreational activity. We are actively looking at added acreage that would allow us to expand our natural land reserve system and to provide the kind of biodiversity that we want to maintain.

Congressman **Akaka**. What kind of actions are necessary to protect biological diversity?

Mr. **Paty**. To answer that I'd like to expand on something Brian Harry said in his previous response. Hawaii is unique in the sense that so many of the components of biological diversity occur only here and having evolved here, and evolved in the absence of all of the browsers which have subsequently been introduced, lack the mechanisms either evolutionary or immediately to compete with that kind of pressure. So we're in the same situation that the Park Service is unfortunately in here; it is not sufficient to buy a piece of property and designate it a National Park or wildlife refuge where we're talking about preservation of rain forests. It is necessary to very actively manage against some of these introduced invasive organisms such as ticks, goats and banana poka, which is a plant, which was illustrated in one of the Conservancy slides, which overwhelms the forest and replaces the native plants. All of this, to manage against that requires very active intervention and constant management and is very expensive. So I would say that the real challenge is not only identifying the lands and setting them aside, but then finding the where with all to manage them. That is where I think we need to place the next focus—in seeing to it that we have the resources as does the park, and the state I would expect, faces the same challenge. Preserving these natural areas is more than setting them aside, it's a very expensive, manpower intensive effort.

Congressman **Scheuer**. Congressman Akaka and I will be looking to increase appropriations for management, needed management actions. Can you give us any additional suggestions of the kind of management actions that are needed on the part of the Park Service, the Fish and Wildlife, the State Department of Conservation and even perhaps private groups that can be funded? Can you list the management actions that are really critically needed so that we can dramatize to our colleagues the importance of increased funding?

Al Marmelstein. Well if you wouldn't mind I'll let my colleagues speak for themselves to answer that question because I wouldn't presume to have the full list for everybody. But I think in our case what we need to do is decide with respect, for example, to the rain forest, areas that we have purchased or have identified for purchase; what we are going to need to do there are the same kinds of things that the Park Service has done in Haleakala National Park and that is build miles and miles of pig-proof fences, remove the pigs from the area once they are fenced and then have a significant ability to maintain those fences because as you saw yesterday when we were flying around, those kinds of storms invariably knock trees down which knock fences down and you have to be able to respond immediately to those kinds——

Congressman **Akaka**. Those kinds of storms also knock helicopters down. That's what I was concerned about——

Mr. **Marmelstein**. I remember that. I remember several questions to the pilot about that. It was my concern as well, I was happy to get back on the ground, but I think that the answer to the question is that we need the staff and the dollar resources to build fences in rainforests and manage against these invasive animals. With respect to some of our other refuges, the refuges that we have in the lowland areas for Hawaiian water birds we have exactly the opposite problem there. In addition to having to keep out certain predators because from a vegetative perspective its always spring in Hawaii, we have enormous problems in those refugees with invading alien plants and that also takes a great deal of money. All these management efforts are very manpower intensive and therefore it takes manpower to effect them and without I'd like to let my colleagues answer their part of that question.

Mr. **Harry**. Each of the park areas have their superintendents and staff that developed requests for appropriations. They have detailed natural resource problem requests. They are not public documents obviously because the Department of Interior likes to review them before they are advertised in the papers. But I would supply you with a copy of those if you wish.

Congressman **Scheuer**. You know what I think would be extremely helpful to Congressman Akaka and the Hawaii delegation as well as the rest of us who support them would be if we could get a consolidated list of management actions that have to be taken.

One list it could be color coded, these are the things that the Park Service has to do, these are the things that the Fish and Wildlife Service have to do, these are the things that the State of Hawaii has to do, and you might even have a separate category for things that non-profits could do if they got additional funding. And that would give Congressman Akaka a handle to go to the big foundations, Ford, Rockefeller, Carnegie to let them know that the private groups can play a very important role in taking the whole scheme of things under consideration and that there is a role for the Federal government and the two agencies we have and there is a role for the state and also a role for the private non-profits and——

Mr. **Harry**. That's why I would be happy to give you our list. We also have for each department, natural resource plans that delineate these items and the rationale for their pursuit. I don't know of anybody who has coordinated this on a statewide basis between Fish and Wildlife, the State, and the Park Service.

Congressman **Scheuer**. Well we have all the representatives right here. You seem to have a good working relationship. You're in the same room here, you're even sitting next to each other.

Why can't you guys get together and let the state of Hawaii sit in and sort of look at the whole pie and then see who should be doing what because you may raise each other's level of consciousness about what should be done and you may each get a consciousness that you have a role that you haven't really thought through completely before, because we know what you're all doing, engaged in brainstorming, of the total job that has to be done. And dividing that total role among the two federal agencies, the state of Hawaii and as I say perhaps the non-profit volunteer groups too.

Mr. **Paty**. If I might add, Congressman, the state has certainly benefited from the opportunity of matching funds. We don't expect the federal government to come in and bail us out with the large amount of work we have to do. But if there is some provision with something on a matching basis could be afforded that gives us the leverage to go to our legislator and to our people and to say, "we could do the job." And the federal government could support it.

Congressman **Scheuer**. And no only can you say we could do the job, but you can say, we hope to get an increased level of funding for the Fish and Wildlife Service and for the Park Service. But they are going to depend on us to do our role too, so if you want the two federal agencies to come in with enhanced funding to say to Hawaii, you have to play a legitimate, respectable role. They are going to expect it like they told us they expect the state of Hawaii to play their proper role. That gives you a little more leverage, to say look we can bring the Feds in but this what they expect us to do. It gives you a little more leverage with the legislature. And the fact that the state of Hawaii is going to commit to do certain things gives Congressman Akaka and the Hawaii delegation a little more clout and a little more credibility in twisting some arms of these federal agencies. Congressman Akaka can say, well look our state is willing to play its role and we hope that you'll match them. So it gives everybody a little extra clout. I thank you very much for your responses, they have been very helpful. One last question. What would be required for the two federal agencies to do a reasonable job with the opportunities that now exist—that is both land that is owned by the federal government or land that is identified with federal ownership. What would be required to maximize the potential and the opportunities that are there now?

Mr. **Marmelstein**. As Brian and I have both said, what is needed right now are the resources, dollars and personnel to manage these lands because we have said before, unfortunately here it is different than on the mainland. Just identifying parts of land and purchasing it as part of a park or a refuge and setting it aside doesn't solve the problem; the same kinds of pressures that cause us to identify the purchase continue once we have purchased it—the invasion of alien plants, the decimation by pigs or goats or what have you, or whatever happens to be the specific mammal in that particular area. So again, I think the answer to that question is the management funds, the annual appropriations for management funds that would allow us to implement the strategies that have been developed for the preservation of these areas.

Congressman **Scheuer**. And you're going to give us an overall strategy and overall management function that ought to be funded with each of your agencies and the state of Hawaii and the two federal agencies playing their proper role to maximize the opportunities that are there now.

Mr. **Marmelstein**. We'll try to get you as much information as we can.

Congressman **Scheuer**. Terrific. Thank you very much, gentlemen. Let me call on the next panel: Dr. Donald Duckworth, Dr. Ken Kaneshiro and Dr. Cliff Smith. Thank you for appearing before this committee and we will proceed first with you Dr. Kaneshiro.

Dr. **Ken Kaneshiro**. I am Ken Kaneshiro the director of the Hawaii Evolutionary Biology Program at the University of Hawaii. First of all I want to congratulate the Congressman for developing the National Biological Diversity Act. I feel that this will become one of the most important pieces of legislation for the future of this planet. I commend you and your fellow Congressman for the foresight and pursuit of passage of the bill which will undoubtedly have international significance. You have already heard from the earlier speakers about the kinds of conservation biology programs at the various state and federal agencies, especially about the excellent efforts of The Nature Conservancy in Hawaii. You've already heard about the incredible bird species, the tremendous diversity of plant species and that there may be as many as 12,000 species of insects in Hawaii and so on. What I want to do this morning is tell you the story of just one group of insects, a family of flies which has provided scientists from all over the world with a unique opportunity to investigate the most dynamic stages of evolutionary phenomena and to test basic concepts of biology as well as formulate new theories which will have wide applications to all organisms. Currently there are 500 species of the family Drosophilidae which are endemic to the Hawaiian islands. We have already in the collection at the University of Hawaii another 250-300 more species which are not described. As we studied previously unsettled areas of the Hawaiian ecosystem we still collect species that are unknown to man in this family of flies. My conservative estimate is that there will be as many as 1,000 species in this family. Just considering the 500 described species in the family, this represents approximately 1/4 of the total number of species in this family worldwide. When you consider the small land mass and the geological units of the islands, the Hawaiian insects represents an incredible example of diversity and successful evolution, Now, detailed studies of the evolution of this group of insects began in 1963 with support from the National Institutes of Health and the National Science Foundation and after the 25 years of studying these flies, more than 60 senior scientists from all over the world have participated in the effort to understand information from new species. Without going into the details of the accomplishments of this project, I want to just say that this has been one of the most comprehensive studies conducted on any group or organisms. In an in-house report published by the National Science Foundation a few years ago, that one project was cited as the leading example of how research should be conducted. Biologists in England published a book called *Island Populations* a few years ago, and one of these chapters focuses on the Hawaiian *Drosophila*. The chapter states that of all the groups of organisms, plants or animals, that can be studied on islands, the Hawaiian flies are supreme. This is why there are a great many species, their ecology is very varied and most important genetic analysis is possible. In his concluding remarks in this same chapter the author states that any other study of evolution must surely seem inadequate after the study of the Hawaiian *Drosophila*. In no other group is so much known, are there so many species and can the ecological relationships be classified so well. They also show the advantages of studying evolutionary phenomena on islands where one group dominates the evolutionary scene in a limited way. There is still an immense amount of work to be done on the group, but the work carried out so far clearly establishes the supremacy of such an impressive study.

[Tape Change 3.]

And also to gain insight into how these species have been able to adapt to a diversity of habitats within relatively a short amount of time. For many years now scientists have considered the Hawaiian islands as the most important natural laboratory for understanding mechanisms of speciation and evolutionary phenomena. The results of the Hawaiian project have certainly provided ample evidence for this. This is the key point I want to make this morning. In order to develop effective programs for conservation biology it is important to understand how organisms come into being in their specific habitats and how they have adapted to both the physical and biological environment. It is important therefore to review the type of evolutionary studies that have been conducted. Because of the wealth of information that has been accumulated on the ecology, genetics, behaviors, biochemistry, physiology and so on most biologists believe that the evolution of biology of endemic *Drosophila* can serve as the model system for understanding the evolution of the unique plants and animals on Earth. I just returned from a five day workshop in Australia, in fact, I got off the plane just 3 hours ago, which was——

Congressman **Scheuer**. Where was the workshop?

Dr. **Kaneshiro**. In Australia, In Armendale. And this workshop was sponsored by the international programs for the National Science Foundation to discuss the ecological and evolutionary genetics of *Drosophila*. I was one of four biologists from the United States invited to participate in this workshop to discuss current research on these flies. During these meetings one of the leading biologists of Australia reported on the value of *Drosophila* genetics for investigating the effects of environmental stress. He stated that because of what we know about the full biology of the *Drosophila* species and I quote "the *Drosophila* should be considered a keystone organism for monitoring environmental stress."

Congresman **SCHEUER**. Excuse me, what organism is that?

Dr. **KANESHIRO**. It is *Drosophila*, it is a family of flies that are very important for genetic research. The result of the Hawaiian *Drosophila* project have provided important insight into the evolution and biology of these insects and the international community for biologists continue to follow the accomplishments in Hawaii for leadership in pursuing exciting research in this area.

However, basic and esoteric these kinds of research may seem to be, they have tremendous application to medicine, agriculture and conservation biology. These like ovary transplantation between species of Hawaiian *Drosophila* have been conducted in the same principle as tissue transplantation in humans. The more closely related the species are the better the acceptance and development of the ovary in the host species.

A few years ago the USDA proposed an eradication program in Hawaii, major funding estimated at approxmiately 1/2 billion dollars over a 10 year period was proposed to eradicate 3 species of pests in Hawaii. These are the med fly, the oriental fly and the melon fly. The original years of the proposal involved a real application of a chemical pesticide to knock down the natural population before applying the so called screwfly technique. Of course with the tremendous biological diversity in Hawaii, such a plan could not be allowed and a letter campaign to our Congressman resulted in the USDA plan being postpopned until alternative means of eradication without the use of insecticides could be developed. Because of our work on the behavioral genetics of *Drosophila* we were contracted to research the basic biology of the pest species of the flies to improve the behavioral quality of the fly strains so that insecticides would not have to be applied in order to maintain control. We are applying the same kind of selection experiments on the species that we have been doing with the Hawaiian *Drosophila*.

Similar kinds of research such as these can be applied to conservation biology programs such as in the captive breeding programs for rare and endangered species. Again in order to stick within the time what I want to do right now is to tell you very briefly what motivated the University of Hawaii to promote these kinds of research programs. We, as I said now have the Hawaiian evolutionary biology program which I will refer to as HEBP from now on and this is under the administration of the curriculum of the biomedical research center. The primary goal of the HEBP is to foster evolutionary research on Hawaii's endemic biota. And we have done a pretty comprehensive study on the Hawaiian *Drosophila* but there are many other plants and animals which are useful for the same kinds of research. The graduate dean just before we left for Australia had just given the go ahead for developing curriculum for a graduate degree program in ecology and evolutionary biology at the University of Hawaii. In conjuncton with this development of a graduate degree at the University of Hawaii, I have been discussing with faculty at Cornell to develop a faculty/student exchange program with Cornell in this field. In the next state legislature, the University will be proposing an action alliance between the faculties of the university's field campus and that of the main campus to develop collaborative research on the native biota on the island of Hawaii. We will develop a collaborative program with the research staff in conjunction with the Bishop museum and I am sure that Dr. Duckworth will mention that as well. So there are many programs at the state and federal levels and at the University of Hawaii which are focussed on evolutionary and conservation biology programs. But we certainly need to continue federal support and even increase federal funding to go even further with these kinds of research. As I said, I think my two colleagues sitting next to me will tell about their own programs and any cooperative measures. Thank you for this opportunity.

Dr. **CLIFF SMITH**. My name is Cliff Smith. I am a professor at the University of Hawaii. I am also a unit leader of a cooperative national park resources studies unit between the National Park Service and the university. Since part of my salary is given to the University by the National Park Service I was informed yesterday that the prepared testimony would have to be reviewed by the Secretary of the Interior and I won't be able to give that at this particular point in time. I would like to make a few comments about a research specialty which I have which is alien weeds in the Hawaiian ecosystem. Over 6,000 species of plants have been introduced to the Hawaiian islands and approximately 900 species have become established in the islands. Which now means that Hawaii has the dubious honor of having an equal number of exotic species as it does native species. Of course this means that there is a tendency for the native species to be swamped and overrun by these alien organisms. And one program that I think needs to be done is pest control by the federal government. In particular is a radical increase in the surveillance and control of the importation of organisms from overseas. To give you an example, there is a botanical garden on this island which introduces 10,000 different forms of organisms every year. What other organisms come piggyback on to them they don't know. But this is the enormity of the problem they do that sort of thing. There are legitimate reasons for introducing species, but that sort of program is ridiculous and can result in only further problems for the preservation of Hawaii's biological diversity. One research program that needs much more federal support in this particular respect is biological control that is research that goes to the native environment of these weeds, looks at their natural enemies, evaluate them for their potential against native species here on the islands and if they are innocuous in that respect, to bring them in to control these species here and to give our native species a chance to survive and I'll leave it at that.

Congressman **Scheuer**. Before we get to the questions on substantive issues could you tell me in detail what the process was by which the Department of Interior told you that you were not free to give your statement? Give that in as much detail as to when and what happened and how you got word would be very much appreciated.

Dr. **Smith**. Yes, I as the unit leader of the cooperative program at the University, report to the regional chief scientist at the office in San Francisco once a week and I sort of detail him of things that I am going to be doing over the next week or two. I mentioned that I had been asked to deliver testimony before this committee and that I was preparing it and reviewing it with him on several occasions during the week and yesterday he informed me that he has advised people further up the line and that they had advised him to tell me to tell you folks that I would have to have my written testimony reviewed by the Secretary of the Interior prior to submitting it. This was directed from the Secretary.

Congressman **Scheuer**. And who was the chap that you spoke to in San Francisco?

Dr. **Smith**. Dr. Bruce Kilgore.

Congressman **Scheuer**. Thank you very much. I may say that I heard from one of the federal officials here that he had been instructed on past occasions when he was in Washington that he was not to go up to Capitol Hill to talk to Congressmen without a representative of that agency present to monitor what he said. Now I don't know how that impresses you people, but I can tell you that I have been to the Soviet Union, and I have been to Poland and I have been to Czechoslovakia and I have sat in on very important meetings with professors, experts and scientists and in most of those meetings there was a little chap from the KGB or the equivalent intelligence base while he is sitting there to monitor what that scientist or expert would say. And I was always shocked and horrified at that process and I thank God that I came from the United States of America where nothing like that could ever happen. Where we didn't need any KGB representatives sitting around monitoring discussions between experts like yourselves and members of Congress who are trying to fulfill their mission by trying to acquire information from the people best qualified to give it. And I am really horrified that this Administration would have indulged in these offensive practices that have to offend any normal American who understands what freedom is all about. I find that kind of directive and the kind of instruction given to a federal official here that he couldn't come to see members of Congress or staff on Capitol Hill without a representative of that agency sitting in monitoring the conversation. I find that offensive to my very core and that is absolutely no reflection on you or anyone else in this room.

Dr. **Donald Duckworth**. Chairman Scheuer, Congressman Akaka, I am Donald Duckworth and I have the privilege of being the President and Director of the Bishop Museum. I might just add parenthetically as a former federal employee with 25 years service the kind of activity you described seemed to become fashionable around 1980 and apparently is still continuing. In the few moments that I have available to me I would like to add my congratulations and those of all of the staff and the Board of Directors of the Bishop Museum to you and to all your colleagues who have provided the leadership in this area. None of us can say enough about both what you have done there in your arena where you have established such an excellent record of leadership on this issue, but also in coming here to assist us those of us here in Hawaii who are working so hard both as individuals and as organizations in this arena to highlight in this fashion the importance of Hawaii. You know at times out here we feel that we are forgotten about, that we are looked upon as perhaps some sort of occasionally thought of foreign territory, which is located out in the Pacific, which is lovely and warm and where obviously no one has to work because it is so warm. And where the normal rigors of hard work fall out. Your presence here today will send a signal and has sent a signal throughout our community that we are in fact primary in the national effort to preserve and maintain biodiversity and this we feel the most significant portion of our national interest.

I have an enviable task in a short time to try to describe for you, the organization which I head, which has existed in Hawaii for the primary concern of gathering, studying, sharing information on the plants, animals, and the cultures of the people throughout the Pacific. The Bishop Museum was founded 100 years ago this year for that purpose; it has spent those 100 years exemplifying the research, documentation, the gathering together of information concerning the environment, the plants and the animals. We have published during that period of time through our press more than 1200 publications, books what have you, more than average, more than most other institutions around the country and around the world in this regard. Our collections are de facto the biological survey of the state of Hawaii and in many ways de facto the biological survey for many of the areas in the Pacific and have been traditionally. To give you some idea of the magnitude of those collections and their significance, and I may also add that we are somewhat unique among the great natural history museums of this country and the world in that we have focused our attentions, our collections, our research and other pursuits strictly to Hawaii and the Pacific that has been long recognized by our sister institutions around the country and around the world and in many instances they have deferred to us and our chosen arena. Thus at this day in age we have become a final league in the national and the world biological research resources for the Pacific and for Hawaii.

Our collections rank amongst the largest in the United States and the world. Our botany department on plant research which we call Herbarium Pacifica now consists of something in excess of 750,000 plants from Hawaii and the Pacific. Many of them of course in our Hawaiian collection represent plants that are now extinct and therefore, as the last record of formerly existing life become invaluable in not only understanding the past but also with modern DNA techniques and so forth provide still a record of lost biodiversity. It has not been a total loss. Our insect collection numbers in excess of 13 million species, the third largest insect collection in the country and the one of the half dozen or so in the entire world. Again focused on Hawaii and the Pacific. And in our zoology department and land and marine snails our collections number more than 6 million. The world's largest collection of Pacific land snails, one of the most unique and interesting manifestations of island and Pacific and Hawaii evolution that is known a major world resource. Our fish collection, although not large in numbers, is one of the most unique in the world in as much as it focuses on fish of the Indopacific region, a high degree of endemism throughout that area while the fish themselves move through that broad area of the ocean. In order to understand fish in Hawaii it is important to understand fish throughout this region. Our collection of Indopacific fish is the second in the country only to that of the Museum of Natural History of the Smithsonian, and is being actively developed as are all of these collections.

The Bishop Museum has been established for over 100 years. We are a private, not-for-profit corporation and have been through that period of time. However, I pleased to tell you that this past session of the Hawaiian state legislature passed legislation which made the Bishop Museum the state of Hawaii's state museum of natural and cultural history and through that if you will public/private relationship provide for an annual approp̄ration to assist Bishop Museum in the care of its collections and the execution of its private and research programs annually from the general revenues of the state of Hawaii. We have had that first bit of support in this fiscal year and expect that relationship to go forward. Our relationship with the state of Hawaii may be viewed as a final wedding after a 99 year courtship. We are pleased to have arrived at that point and we feel it only appropriate that it happen at this moment in time when the activities of the museum provide the fundamental basis of information which are so critical. I might also add that I think that action of and by itself is a direct indication of the importance that Governor Waihee and the legislature and I understand that in the final passage of the bill there was not a dissenting vote in either the Senate or the House of Representatives as a reflection of their concern about the importance of the holdings of the Bishop Museum, by the information represented by its collections, the importance to the people of Hawaii and the nation and the Pacific.

I would like to quickly run through some of the activities in research that we are doing, on-going activities, as I mentioned earlier, we have had as a fundamental part of our charge through the years—research. First of all I would like to report to you about a project which will appear in published form in a few months, co-published by the University of Hawaii press and Bishop Museum press. It will be a handbook of the flowering plants of Hawaii. It is a project that has been conducted and has been brought to conclusion by personnel of the museum in collaboration with personnel from the Department of Interior, Fish and Wildlife Service. It is the first inventory of the native plants of Hawaii to be available in 100 years. It was a five year projected funded by resources of the Bishop Museum, support from the Irwin charitable foundation in San Francisco and the National Science Foundation. We are pleased to be able to say at this moment that we have provided the foundation for the conservation, the management, the preservation of biodiversity for Hawaii from the plan perspective.

We have other activities in our plant research operation that coincide with our interest in biodiversity. As a matter of fact, in addition to the flowering plants we also produced a publication a few months ago, a bibliography of all the scientific information published on the flowering plants of Hawaii. We currently have a field research project going in New Guinea that is being funded by the National Cancer Institute. We are collecting rare rain forest New Guinea plants for return to the United States for survey for any cancer agencies in their plant chemistry make-up. As that activity is going on, it is also providing the Bishop Museum with the opportunity to collect and build our understanding of biodiversity in New Guinea. We have a project sponsored by the National Science Foundation which is doing a manual of the seaweeds of Hawaii those most important marine plants useful in a variety of pharmaceutical and agriculture in a variety of different ways. It will be a three year project and we expect to have a complete survey of the seaweeds of Hawaii at the conclusion of that. We have a variety of other programs in plants.

Our primary focus at this point in time is to conduct an invertebrate survey, a terrestrial invertebrate survey of Hawaii. We have inventoried the plants, we are confortable with the status of the plants that are coming out of that project. We are now moving into the large and much more challenging arena of developing an inventory and an understanding of the terrestrial marine invertebrates, the insects, related arthropods such as spiders, centipedes, and so forth, and the land snails, large important areas. This is a project which is going to take at least 5 years. It is going to take considerable sums of money, probably something on the order of a million to a million and a half dollars a year. We have preliminary study funds and have conducted a workshop this past November on this project. That activity was funded by the MacArthur Foundation in Chicago and we are now developing the details of the project which we hope to look to a variety of sources for support and funding.

I will skip over some of the other activities. It would suffice to say that in the area of plants, insects, fish, marine invertebrates, land snails we have projects going on and projects in the planning phase which will further develop our collections and our resource base to provide information in a timely and more efficient fashion to those other individuals, agencies, and organizations that need to translate that basic understanding and knowledge into the action programs of management and conservation further, and more elaborate research such as Ken Kaneshiro has described from the University of Hawaii.

In our education department we have a program that is funded by the MacArthur Foundation of Chicago in which we are doing a collaboration with the state department of education as well as the memorial gardens foundation—it is a curriculum development program funded in four years in almost a million dollars of support to develop for Hawaii public schools, Hawaii schools, public or private, an environmental education curriculum which will allow our youngsters in school to learn about the unique nature of the land in which they live, the islands themselves, the unique flora and fauna. With little exception, most of the environmental education traditionally in Hawaii has been achieved through the use of curriculum materials and books prepared for mainland U.S. schools. Therefore, the youngsters have learned about oak trees and chipmunks and robins. And it is little wonder that in the case of public policy issues affecting the nature of this environment—tropical insular environment—are going was that not always the best public decision was arrived at. We are very proud of this program. We are very pleased with the broad array of individuals and institutions in this state that are collaborating with us in the development. We consider it again another indication of Hawaii's dedication to both its public and private organizations of research and work necessary to go forward.

Two final points I would like to make. From a federal standpoint and from the perspective of the national biodiversity act we are in full and enthusiastic support of the concept of a national biological survey to be centered at the Smithsonian Institution. We feel that it is long overdue, that it is an element of leadership, coordination and trust that is needed by all of us throughout the country to execute our responsibilities. We feel at the Bishop Museum that our traditional stance in Hawaii and the Pacific puts us in a very appropriate position to be a subset of that national survey focused as we are on Hawaii and the areas throughout the Pacific and we would be more happy to have the ultimate legislation when its passed reflect that and its subsequent implementation have some facility for us to lead and coordinate that portion of the national biological survey which is directed to our 50th state.

I would also like to make a strong plea for additional federal support through all agencies for the care, upgrading, preservation, organization and information management of collections. Biological collections of biological diversity serve the same role as the national and international units of standards and the bureau of standards or the basic demographic information at the bureau of the census. We are fundamental to managing this information to developing it. And those collections which are not only specimens but also a huge array of associated information—it documents. It costs a great deal of money to maintain, preserve and house—the Bishop Museum over the last several years has been spending in excess of a million dollars a year upgrading, improving our equipment. We are in the process of building a new building which includes new collections storage space. The acquiring of hardware and software for electronic data processing of most of the collections is expensive and complicated. The National Science Foundation through the Biological Research Resources Program has been our primary source of funding and they have been very helpful. But that program is small and there is a large national network of museums that we peddle. Whatever assistance in that arena that you could influence through your role in Congress would be deeply appreciated. I have gone on far too long. I apologize. I feel very privileged to be asked to be here today. Thank you very much.

[The prepared statement of Dr. Duckworth follows:]

The Research Needs and Challenges Relating to the Preservation and Maintenance of Biological Diversity in Hawai'i

Testimony submitted by W. Donald Duckworth, President and Director, Bishop Museum, to Representatives James H. Scheuer (D-NY) and Daniel K. Akaka (D-HI) during a Congressional briefing held on January 11, 1989, in the State Capitol Auditorium, Honolulu, Hawai'i.

It is an honor and a privilege for me to be invited to appear before you today, and I am grateful for the opportunity to participate in the discussion of this most important contemporary issue. I am especially pleased that you have taken time from your busy schedules to have this briefing in Hawai'i, where so many elements of our national and international concerns and challenges related to the preservation and maintenance of biological diversity are present and of singular significance.

Bishop Museum is the oldest and largest natural and cultural history institution in the Pacific, and its 100 year history of gathering, preserving, studying, and publishing knowledge of the plants, animals, and cultures of Hawai'i and the Pacific region is nationally and internationally recognized and respected. Its collections of plants and animals from all habitats are among the largest in the United States and throughout the world.

The Museum's century-old focus on the Pacific, especially Hawai'i, has further added to the value and impact of the collections inasmuch as other institutions have traditionally recognized our emphasis on this one vast region and have cooperated and collaborated with us when their interests and activities touched on the Pacific. Thus, Bishop Museum is not only a significant research source and information center for Hawai'i and the Pacific, but a singular and unique element in our national reserarch and knowledge base for understanding, preserving, and maintaining biological diversity.

Research has always been an important and integral part of Bishop Museum's mission. In fact, through the years many of the equally important roles similar institutions play in their communities—such as exhibitions and education—were placed at a lower priority as the Museum worked hard with very limited financial resources to gather and study before the ever-increasing pace of change overwhelmed the fragile and unique organisms and habitats found here in Hawai'i and throughout the Pacific. Always cooperating and collaborating with other institutions—universities, federal agencies, state agencies, and private organizations—as well as individuals from around the world, Museum researchers accumulated an extraordinary wealth of knowledge and built a respected record of accomplishment. As the pace of change has increased with time and technological advances, so too has our sense of urgency to document and understand the composition and complexities of the Pacific biological heritage.

Toward that end I would like to describe briefly the activities we are currently engaged in and some of our plans and aspirations for the future. Through support from the National Science Foundation and the Irwin Charitable Foundation in San Francisco, we have completed the first modern inventory of Hawaii's plants. Due to appear later this year as a joint publication of Bishop Museum Press and the University of Hawaii Press, it is perhaps the best example of the kind of fundamental inventory and basic research that is needed to provide the basis for thoughtful and effective habitat management and public policy decisions.

Also in our plant research program is an NSF-funded study of the seaweeds of Hawai'i. Underway now for a little more than a year, the project has led to the discovery of new species, and a great deal of new basic knowledge has been gathered and synthesized concerning this important group of plants. We have important projects underway in other critical areas of the Pacific. In the Philippines, the Museum is lending its expertise to the planning of a massive project to update knowledge of the flowering plants there. As part of the planning process, and again with NSF support, Bishop Museum last year sponsored on its grounds a workshop attended by renowned botanists from the U.S., the Netherlands, and the Philippines. In Papua New Guinea, where Bishop Museum has conducted research for many years and founded the Wau Ecological Research Station, we currently have botanists collecting plants for evaluation of their potential use as anti-cancer agents. This work is being done as part of a project supported by the National Cancer Institute. The project is also providing the opportunity for plant specimens from many unique and endangered habitats on the world's largest tropical island to be sampled and documented for study.

Museum scientists are prepared to undertake a similarly ambitious—and vitally important—effort with insects and snails, and have indeed begun such work. Bishop Museum's insect collection consists of more than 13 million specimens. Support for the development of a computerized data base of Hawaiian insects and related arthropods has come from the James D. and Catherine T. MacArthur Foundation, but in order to carry the project through to completion, substantial additional resources will be needed. When it is completed, it will include basic taxonomic, bibliographic, and biological data on more than 8,000 species. As with the botanical work the Museum has engaged in, these studies will seek to document the extent of diversity that exists and determine which habitats are most critical for species preservation.

The Museum last yer entered into a four-year project that has immense potential for public impact in ways closely related to biological diversity. The project brings togethera large body of relevant resarch done at the Museum and elsewhere with the goal of shaping it into an elementary school curriculum on tropical ecology. Called the 'Ohi'a Project, it is a collaborative undertaking with the Hawai'i State Department of Education and Monalua Gardens. Its objective is a curriculum tht uses examples of tropi~~cal~~ island ecology and serves as a catalyst for building a broad, community-based awareness of the uniqueness and fragility of Hawaii's flora and fauna.

Thus, Bishop Museum continues, in cooperation with other organizations and individuals, to conduct and expand its research endeavors and to develop modern information systems to better access the steadily growing data bases. However, the rate of research is far too slow and resources too limited to cope with the accelerating rate of change in the environment. Public policy-makers, conservation biologists, land managers, etc., have urgent need for fundamental information now, and we are constantly frustrated by the difficulties we face in meeting their needs.

By far the most encouraging contemporary initiative in the country, if not in the world, has been the introduction of the National Biological Diversity Act of 1987. While yet to achieve passage into law, the bill recognizes the urgency of the problem and the desire on the part of enlightened and concerned national legislative leaders to provide a strong national stance on this critical issue. It has offered a bright light of hope at the end of a long, dark tunnel of concern and anxiety. I know I speak for all of us here when I commend all those who provided leadership and support for this effort.

I would especially like to add our strongest endorsement of the concept of a national biological survey to be centered at the Smithsonian Institution. The nation has needed this organized and coordinated program for many years in order to better understand and manage our precious natural heritage. We would hope and urge that the unique national asset represented by the State of Hawai'i would be recognized and supported in a leadership context throughout the legislation and subsequent implementation. Our tropical island environment and "U.S. gateway to the Pacific" geography should be ample justification to provide a "model" for the Pacific, indeed the world, of our national leadership in preservation and maintenance of not only our country's biological diversity but tropical biodiversity worldwide. Bishop

Museum, with its 100 years of experience and accumulated expertise, would be privileged to be the focal point of this fundamental survey endeavor.

By far the most critical need we face is finding the financial resources to execute the needed research, provide the facilities and computer systems to document, organize, analyze and access the specimens and data, and produce and publish the results in ways that are of immediate use to all segments of society.

This is admittedly a tall order. However, the combined activities and resources of federal, state, and private institutions are already engaged in the effort. The passage of an effective National Biological Diversity Act should provide the framework that is needed to coordinate present efforts and foster new ones. Here in Hawai'i, there is the momentum of the past, the talent and energy of the present, and a commitment to the future. We can provide the clearest signal to the nation, the Pacific, and the world that the American priority to preserve and protect the planet's biological diversity is of the highest order, and that we are prepared to lead by example within our states and territories.

Lastly, I would like to say a few words about the fundamental resource from which any conclusions about biological diversity need be drawn. I am referring, of course, to the systematic collections of biological diversity held in museums around the country, such as Bishop Museum. These collections, and the registers, books, files, etc. associated with them, and especially the people associated with museums, have constituted the basic resource for cataloguing and understanding our biological heritage, and they will continue to do so in the future. If we are to be successful in all aspects of our efforts in conservation, habitat preservation and management, public policy decisions, etc., we must develop means for enhancing resources in support of the care, expansion, and improved availability of the data base from which all else is derived.

Primary support for collections care and development has come from the Biological Resarch Resources Program of the National Science Foundation. Since its establishment in 1972, some $49.2 million have been provided in matching support to institutions to improve the care and utlity of collections. It has simply not been enough. The BRR Program has grown only modestly in the past several years, and collection support has been diluted by other demands on the Program. Funds for support of collections are in the range of a few thousand dollars per collection at most institutions. Museums face increasing backlogs of unprocessed specimens as research and inventory activities increase, especailly in plants and invertebrate animals. The new types of collections for research need more expensive kinds of care. An ever-growing array of users of collection information requires computer-generated information, which has high hardware and software costs. There are preservation problems in many of the older specimens which were gathered and housed in earlier and less sophisticated times. These latter speimens are of great importance inasmuch as many document times and places that have disappeared and, in some cases represent species which are now extinct.

In addition, new understanding of human health hazards and increasingly stringent government regulations affect the ways we house, preserve, and access collections. Clearly, increased federal funding for the BRR Program, specifically directed towards improving and maintaining our national systematic collections, is fundamental to our ability to understand, preserve, and maintain biological diversity. At Bishop Museum we are spending several millions of dollars annually to build new collection space, upgrade and modernize existing space, and install modern equipment. We are doing our very best, but more is needed if we are to truly meet the research andinformation needs of Hawai'i and the Pacific.

I am taking this opportunity to append some additional information for clarification and elaboration of previous points. Thank you very much for the opportunity to appear before you.

BIOGRAPHY OF W. DONALD DUCKWORTH

W. Donald Duckworth assumed the duties of President of Bishop Museum (A Hawai'i not-for-profit corporation) and director of Bernice P. Bishop Museum on January 1, 1986. Prior to that date he had served as director of Bernice P. Bishop Museum since August 1, 1984.

He came to Hawai'i from the Smithsonian Institution, Washington, D.C., where he was Special Assistant to the Assistant Secretary for Museum Programs with primary responsibilities for coordinating the planning for the Smithsonian Institution's $50 million Museum Support Center.

Dr. Duckworth has been Special Assistant to the Director of the National Museum of Natural History and Curator in the Department of Entomology. An internationally recognized authority in his research area, he holds leadership positions in several professional societies and participates on a variety of national and international committees. He has conducted field research and museum studies in North America, Europe, Australia, and throughout Central and South America. He is a past president of the Entomological Society of America and of the American Institute of Biological Sciences---an organization representing over 70,000 biologists in the United States. He is currently President of the Pacific Science Association, the XVII Pacific Science Congress to be held in Honolulu in 1991, and the Association of Pacific Systematists. A native of Athens, Tennessee, Dr. Duckworth completed undergraduate studies in biology at Middle Tennessee State University which recognized him in 1984 with its Distinguished Alumni Award for Professional Accomplishment. He earned both his Master's and Doctorate in entomology at North Carolina State University. Dr. Duckworth has authored numerous articles for scientific publications, lectured widely, participated in the development of exhibit, research, collections management programs, and has served as planning consultant for federal agencies and various museums and universities.

He resides in Honolulu with his wife, the Honorable Sandra L. Duckworth, a professional fund development and project management consultant and former elected official of Northern Virginia and officer of the Virginia and National Democratic Party, and their three children.

/9:88

Congressman **Akaka**. Thank you. Just one question in light of your comments. You know that H.R. 4335 establishes a center for biological diversity and environmental research and that is in the bill and from what you said you certainly encourage that. How would a center like that help you to do research on biodiversity?

Donald Duckworth. From our standpoint we would see from the Smithsonian a coordinating endeavor which would provide coordination for all of the systematic resources, all of the collection resources throughout the nation. That coordination would be extremely important because we all hold information that is of value importance to each other. Standardization of computer systems to transmit that information quickly, standardization of practices and processes for handling collections, storing and preserving. We have serious problems with preserving material. Some of our older material, collected in a time when the best techniques to prepare the material, and house it were not known; some of our rarest and most valuable material have serious preservation problems. We need a great deal of research in that arena to help us keep this material on in perpetuity. We would expect in Hawaii, for example, with our relation both with the Smithsonian and with other museums throughout the country to be looked upon as the focal point for that portion of the biological survey which focused on Hawaii. We are tropical. We are an island. We are not continental and we are not temperate and our collections by far are the strongest collections in the world to conduct that activity. So we would seek money. The bottom line on all of this is dollars. We don't have enough people. We don't have enough equipment. We don't have enough information exchange. The more support we can get—we are all prepared to stand muster for what we use that money for and how we use it—that we use responsibly. The tunnel has been long and dark. The National Biodiversity Act and implications it has on our activities provides a very faint but growing light at the end of that dark tunnel. I believe gentleman that you find both here in Hawaii and throughout the country our profession, our business ready to go to work. We need the resources and we need them badly.

Congressman **Scheuer**. We have heard that and I must confess that Congressman Akaka and I have received a lot of support from all over the country and from people in the conservation, biological diversity community so to speak. How do your research projects here in Hawaii serve as a model for both national and international efforts to use biological information survey—biological survey information to develop conservation priorities both in the United States and abroad?

Donald Duckworth. I think some of the earlier comments about the advances of conservation in Hawaii from the federal agencies, first of all I would like to make it very clear and reiterate what others have said. We have a good working relationship, across agencies, state, private, federal across organizations conservation research, what have you. We are finding our roles and we are finding our ways. We all come from different kinds of histories and heritage and we work within differing systems; however, we feel that in our contemporary research development I could use no better example than the manual on the flowering plants of Hawaii. As that research was going on, as the data were being gathered and the scientists were producing the information, as it was produced that information was made available to The Nature Conservancy, to the state, to federal agencies immediately to take and translate into management and action activities. We look at all our research activities in that connection and in our management of our large data bases which are the collections.

Congressman **Scheuer**. Are you in effect telling us how earlier and on going research of the factors that threaten populations of rare and endangered species can be used and can be incorporated into management practices? Is that what you think?

Donald Duckworth. Absolutely, and I think that is the primary thrust of most of the research activities that are going on and that is certainly true of the Bishop Museum. Our determination first and foremost is that we must find what is out there. Hawaii is a small state; it has an excellent flora and fauna. We are now comfortable that we have a handle on the flora but I should add that Hawaii is a difficult state. You gentlemen yesterday had a small example of how difficult it is to do biological field work in Hawaii. The terrain is at best risky and dangerous, time consuming. Therefore we still have a lot to learn and when we get into the invertebrates, for example, where we are talking about probably 12,000 species or more of insects we must document them. But as we document them we are also providing the basis on which all of the rest of the information is built. The management information, other research, more sophisticated research and so forth.

Congressman **Scheuer**. Are you mostly involved in research that develops information about biological diversity on an ecosystem level or are you mostly looking at the elements factors that threaten biological diversity as regards to a single species in sort of an add on basis.

Donald Duckworth. I think that it is fair to say that we are doing all, but we are driven by the priorities and the realities of where we are and what is happening. We are looking to gather information, specimens which document the species that are there, all the information that can be gathered. The museum world has changed dramatically, we are no longer those quiet dusty places where one enjoys intellectual incest and a golden grotto with green eyeshades and sleeve garters. Our people are out. Our techniques are sophisticated. We are working in collaboration with others: Dr. Kaneshiro and his group at the university, the Park Service, the people at The Nature Conservancy. We are all working together gathering that information. Our first order of business is to conduct that inventory. Higher levels of activity go on all at the same time. We have probably the world's leading cave ecologist on our staff who has revolutionized thinking about cave evolution based on his studies of lava tubes in Hawaii. We are working on all of these levels, but primary to our responsibility is to get that inventory and feed the action teams with federal and state agencies, with The Nature Conservancy, Audubon Society and other groups. We are that fundamental resource and we take it very seriously.

Congressman **Scheuer.** You remember we asked the three members of the original panel representing the state, the Fish and Wildlife Service and the National Park Service. We asked the three of them to put together the total job that has to be done and what their slice of the pie would be. Dr. Duckworth maybe you could provide some input?

Donald Duckworth. We were hoping you would ask.

Congressman **Scheuer.** I would not only ask but I would request it. Look at the total role. You have a role specific delineation in there and it seems to me that would give you a real handle in beating the bushes and raising money and going to the foundation, whoever and saying—look, we have an important role and its an occasion where we all have to pull our own weight and where the whole is greater than the sum of the parts. If all of us pitch in, we do have a unique contribution to make. Can you help us to make it? I could almost write your fund-raising speech for you.

Donald Duckworth. I would be most happy to have that assistance in return.

Congressman **Scheuer.** Seriously wouldn't——

Donald Duckworth. Yes, that is a real question. That's exactly what I think we are all about today.

Congressman **Scheuer.** I hope all three of you will get together and collaborate. I just think that the four legislators from Hawaii are going to be able to use this as a tool with other Members of Congress supporting them when they take the lead. And they are just going to find this a very helpful tool in raising the level of consciousness both in the Congress and in the federal agencies involved. So I would appreciate that very much.

Donald Duckworth. And you are also doing a marvelous job for the luncheon business here in Hawaii. We are going to be having lots of lunches together.

Congressman **Scheuer.** Great. Thank you very much. Keep it a low cholesterol luncheon. We need you guys around for a long long time. The last panel we have here on our agenda is Marie Morin of the Hawaiian Audubon Society, Susan Miller, Natural Resources Defense Council, Marjorie Ziegler, Sierra Club, Rick Scudder, Conservation Council for Hawaii.

Susan Miller. Good morning, Congressman Akaka, Chairman Scheuer. My name is Susan Miller. I am a member of the staff of the Natural Resources Defense Council serving as their Hawaii representative. Perhaps one of the newer staff members, since the Hawaii office only opened here last year. Congressman Scheuer indicated earlier and I believe Congressman Akaka is familiar with the Natural Resources Defense Council. I don't have to tell you too much about the work that we have done in Congress advocating for additional funding for research particular for management for the Fish and Wildlife and Park Services.

Congressman **Scheuer.** And they are very strong supporters of the bill that Danny Akaka and I are sponsoring on biodiversity.

Susan Miller. That is correct and we certainly join them. The National Resources Defense Council was brought to Hawaii by a grant from the MacArthur Foundation.

Congressman **Scheuer.** From which foundation?

Susan Miller. The MacArthur Foundation. They provided funds to open an office here, and so therefore it becomes a fourth office of the Natural Resources Defense Council. One of the first projects that we are working on or the first project that we were working on is a report on the status of protection of rare native species in

Hawaii. Looking at the efforts that are being made, particularly on the federal and state levels and that report has been drafted and has gone out to a review committee. We are in the process of analyzing and synthesizing that material that comes back and the reviews. We will certainly provide at the earliest opportunity to both of you copies of the final report.

I would like to mention very briefly three items that we have found are I think almost unanimous agreement on needs to help protect biodiversity. Needs that have been mentioned by others and I will not mention all of them but I would like to mention them perhaps from slightly different perspectives. Research, research funding, particularly long term. Research funding has been given to the Fish and Wildlife Service and also the Park Service on a year-to-year basis. And you can't do research on ecology and the behavior of organisms particularly the kind of environments as you saw yesterday on a short-term basis. You can't just take a snapshot. We need to be able to have long-term funding, so whatever can be incorporated within your biodiversity bill that would encourage Congress to give long-term funding, perhaps to set up a blind item, for example, in the Fish and Wildlife Service budget for Hawaii ecological research as I know has been done for certain projects, such as the whooping crane.

Management has been mentioned and there is a need for management always. The question Congressman Scheuer asked earlier, implying numbers of money that would be needed to protect Hawaii's biodiversity. What kind of money are we talking about? In looking at the process of developing recovery plans and implementing those recovery plans for endangered species, we feel that the amounts—we are not talking about a ten percent increase. We are probably talking about a two, three, or maybe even fourfold increase in what is available now. We are talking millions of dollars. It is not a small amount.

The last item I would like to speak to is coordination. It has been mentioned that there is good coordination and we agree. We are under the impression, very strong impression, that a position within Fish and Wildlife of endangered species coordinator has been merged into another position and one person is perhaps trying to do more than one job. And there really isn't anyone who is the same to all the people involved, the Federal people, and the state people and to an extent the private people. We have I think, some 30 species covered, listed endangered species covered by recovery plans that have detailed implementation. But there is no one out there pointing out—look, we need to do this and this and this and this is the way what you are planning could be changed to fit into that. We need that kind of specific coordination to help implement the recovery process. That is when you need that thrust. The coordination between researchers and agencies and in the agencies and university and in such things as botanical gardens is going on and if anything can be done to improve that that would help.

Lastly, simply information about who has involvement in the endangered species protection issues in the state. I participated and provided the Department of Land and Natural Resources to help them respond to a House resolution from last year's legislature, with a list, which I am told this is the first time this has been done. Just trying to list the entities that touch on the protection of native species. It includes the military, you can't forget that what the military does affects native species. There are whole layers of people and some of these people are doing active things; some of them are doing passive things but nowhere is all of that coordinated together. And so I think that it is likely that perhaps the national center that you mentioned—you might consider some sort of perhaps regional or maybe even state affiliate centers that could provide the information in a more local way. There is no one place where you can go to find out what everybody is doing and that would be timesaving to a lot of people. I appreciate the opportunity to share my views and I would like to turn it over to the representative of the Sierra Club, Hawaii chapter.

MARJORIE ZIEGLER. Aloha! I am Marjorie Ziegler, speaking on behalf of the Sierra Club Hawaii Chapter. I am also employed with the Sierra Club Legal Defense Fund, as a resource analyst, and am a graduate student at the University of Hawaii. I would like to talk about accountability of agencies—public agencies that are legally responsible for preserving biological diversity in Hawaii. Here that is primarily the Fish and Wildlife Service, the National Marine Fisheries Service for marine species and the Hawaii Department of Land and Natural Resources. There are however a lot of other organizations and individuals involved in this. We have very good statutes on the books to protect species; however full implementation of these laws has not occurred in Hawaii for several economic and political reasons. How can the U.S. Congress address the issue of accountability and contribute toward preserving biological diversity in Hawaii? Three possibilities are legislation, increased funding, and adding Federal funds appropriated to the state program.

I'd just like to offer seven specific recommendations very briefly. Number one, enact a Federal statute that would identify and protect endangered ecosystems and include long-term funding to implement the statute. I think we all agree that the most effective and efficient way to manage, I'm sorry, to preserve diversity is to actively manage functioning ecosystems. The U.S. Congress Office of Technology Assessment report of 1987 states that the long-term solution to the endangered species problem requires ecosystem-level planning. Although the purpose of the Federal Endangered Species Act is to protect species and the ecosystems upon which they depend, agency accountability for implementation efforts and omissions has been a problem throughout the history of the Act.

Number 2, pass a bill that would establish a commission to assess the adequacy of existing Federal programs for preserving biological diversity. Federal agencies to be assessed should at least include the Fish and Wildlife Service, National Marine Fisheries Service, Forest Service, National Park Service and Department of Defense. In Hawaii, and this is just sort of a ball park figure but I have been doing a lot of research on endangered species, I am just guessing very roughly a few dozen or so strategically chosen species added to the Federal Endangered Species List and if full implementation of the Federal Endangered Species Act was to take place I think we could probably protect a lot of the main major areas that still need to be protected and that are worth saving in Hawaii. So again there are good laws on the books but not full implementation of these laws.

Number 3, amend the Federal Endangered Species Act to require the Fish and Wildlife Service and the National Marine Fisheries Service for marine species to establish firm initiation dates for implementing recovery plans, these plans are written for listed species as you know. In Hawaii, we have 58 listed endangered or threatened species. We have 13 recovery plans which have been written, approved, and distributed. These 13 plans cover 31 species. As far as I know there has been no organized and systematic effort to implement these plans and they are very good plans with specific laundry lists of what is needed. There is also in Hawaii, a draft recovery, I guess a draft master recovery plan that was prepared by the Fish and Wildlife Service which is very good. It puts together all the existing plans and identifies key areas and key efforts that are needed. And I have been trying to get a hold of this report and I have not been able to see it at this point. I am pursuing this, but I think the Fish and Wildlife Service could act more actively, implement this master plan.

Congressman SCHEUER. And who developed the master plan?

MARJORIE ZIEGLER. The U.S. Fish and Wildlife Service here in Hawaii. It was by the person who held the position that Susan Miller spoke of. I think sort of a recovery, a recovery endangered species recovery coordinator which is——

Congressman SCHEUER. Do you know who that was?

MARJORIE ZIEGLER. Peter Stein who is still with the Service but——

Congressman SCHEUER. Is he with the Fish and Wildlife here in Hawaii?

MARJORIE ZIEGLER. No, he is in California. He moved. So number 4 pass a bill that would relieve the U.S. Army Corps of Engineers' responsibility to protect wetlands. In Hawaii, I am specifically concerned with wetlands for endangered water birds and anchialine ponds which are unique in the United States to Hawaii that fall under the Corps of Engineers' land dredging and are required for activities along the coast.

Number 5, enact a bill that would establish and provide long-term funding for a Fish and Wildlife Service Cooperative Wildlife Research Center in Hawaii. Peer-agency pressure and coordinated cooperative efforts could really go a long way to help preserve the diversity here.

Number 6, pass a bill that would require an audit of the Hawaii Department of Land and Natural Resources. If necessary, you could make this a requirement of the state's receiving federal funds for endangered species and wildlife management. I think law enforcement, state leases of forested lands and the state's multiple/use policy in native forests need to be especially looked at.

And finally, add provisos to Federal funding to existing Federal funding and future federal funding for state programs to ensure that land management conflicts are eliminated or avoided. We get money from section 6 of the Endangered Species Act, we also get some money for endangered species programs and wildlife management from Pittman-Robertson, money which is an excise tax from fire-arms and ammunition sales. Unfortunately I think that there are conflicts in certain areas where we are trying to protect species and also provide recreational hunting. Finally, I would just like to say that civil lawsuits filed under the Endangered Species Act; and other environmental statutes are often necessary to make involved agencies more accountable. As John Fitzgerald, one of the leaders in the Endangered

Species Act Reauthorization Coalition put it, the large number of successful lawsuits filed under the Federal Endangered Species Act is an indication of the many opportunities for saving endangered wildlife missed by agencies due to lack of funding and aggressive enforcement.

Congressman **Scheuer**. Would you repeat that statement because sometimes when you drop your voice I have a hard time hearing you.

Majorie Ziegler. Sure, I'm sorry. John Fitzgerald says that the large number of successful lawsuits filed under the Federal Endangered Species Act is an indication of the many opportunities for saving endangered wildlife missed by agencies due to lack of funding and aggressive enforcement. I think that it is very unfortunate that private citizens have to spend their time, and their energy and their money forcing public agencies to do what they are legally required to do in the first place. For instance, and I don't want to dwell on the past but I would like to point out that it cost the citizens of Hawaii $295,202.50 to protect the endangered palila bird's habitat on Mauna Kea.

Congressman **Scheuer**. That spent money on?

Majorie Ziegler. Just on money awarded to the litigation costs.

Congressman **Scheuer**. It seems like a bit of a waste doesn't it?

Marjorie Ziegler. It certainly does. You know this price resulted from a civil lawsuit, two civil lawsuits actually and couldn't this money as you pointed out have been better spent elsewhere? So I hope that your Committee will use its power to pass legislation that will result in new statutes to preserve biological diversity, but also to add laws to better implement and enforce the existing statutes that we have. We appreciate the opportunity to comment. Thank you.

[The prepared statement of Ms. Ziegler follows:]

House Committee on Science, Space, and Technology
Subcommittee on Natural Resources,
Agricultural Research, and Environment

Congressional briefing on preserving biological diversity
January 11, 1989

Sierra Club Hawai`i Chapter
Statement on preserving biological diversity in Hawai`i

Congressman Scheuer, Congressman Akaka, and members of the Committee:

Aloha! I am Marjorie Ziegler speaking on behalf of the Sierra Club Hawai`i Chapter. I am also employed with the Sierra Club Legal Defense Fund, Inc. and a graduate student at the University of Hawai`i.

I would like to talk about accountability of public agencies that are legally responsible for preserving biological diversity. In Hawai`i, primary agencies include the U.S. Fish and Wildlife Service, National Marine Fisheries Service, and Hawai`i Department of Land and Natural Resources, although other public agencies and private organizations are involved. We have very good statutes to protect species on the books, such as the Federal and State Endangered Species Acts; however, full implementation of these laws has not occurred in Hawai`i for economic and political reasons.

How can the U.S. Congress address the issue of accountability and contribute toward preserving biological diversity? Three possibilities are legislation, increased funding, and adding provisos to existing Federal funds appropriated to the State. Specific recommendations are listed below:

1) Enact a Federal statute that would identify and protect endangered <u>ecosystems</u> and include long-term funding to implement the statute. The most effective and efficient way to maintain biological diversity is to protect and actively manage functioning native ecosystems. The U.S. Congress Office of Technology Assessment report (1987) states that the long-term solution to the endangered species problem requires ecosystem-level planning.

   Although the purpose of the Federal Endangered Species Act is to conserve endangered and threatened species <u>and</u> the ecosystems upon which they depend (16 U.S.C. § 1531), agency accountability for implementation efforts and omissions has been a problem throughout the history of the Act.

2) *Pass a bill that would establish a commission to assess* the adequacy of existing Federal programs for preserving biological diversity. Federal agencies to be assessed should at least include the Fish and Wildlife Service, National Marine Fisheries Service, Forest Service, National Park Service, and Department of Defense.

In Hawai`i, adding a few dozen or more strategically chosen species to the Federal Endangered Species List along with full implementation of the Federal Endangered Species Act (i.e., designating critical habitats and initiating aggressive recovery efforts for listed species) would probably result in the preservation of most of the natural areas still worth saving in the islands. This would contribute to preserving biological diversity in Hawai`i and globally since many Hawaiian species are endemic (i.e., unique to the islands. Unfortunately, full implementation of the Act has not occurred and involved agencies need to be made accountable for their omissions.

3) Amend the Federal Endangered Species Act to require the Fish and Wildlife Service (and National Marine Fisheries Service for marine species) to establish firm initiation dates for implementing recovery plans, which are written for listed endangered and threatened species.

This amendment is needed in addition to the 1988 amendments, which address recovery plans, and could be discussed at oversight hearings. Incidentally, since 1976, one or both houses of the U.S. Congress have actively considered amendments to the Endangered Species Act every year except 1983 and 1984.

A total of 13 recovery plans covering 31 endangered and threatened Hawaiian species have been written, approved, and distributed. Many of these plans were written in the late 70's and early 80's and have not been implemented in an organized and systematic way. A case in point is the Hawai`i Island Forest Bird Recovery Plan, which was approved in 1983 when listed birds still occurred on the Kona (west) coast of

Hawai`i. Today, most of these areas are probably only marginal habitat for some of these species. RECOVERY PLANS NEED TO BE IMPLEMENTED AS SOON AS THEY ARE APPROVED!

4) Pass a bill that would take away the U.S. Army Corps of Engineers responsibility to protect wetlands. What does the U.S. General Accounting Office say in its recently completed investigation of the Corps' handling of wetlands?

5) Enact a bill that would establish and provide long-term funding for a FWS Cooperative Wildlife Research Center in Hawai`i. Peer-agency pressure and coordinated cooperative efforts could do much to preserve biological diversity here.

6) Pass a bill that would require a (Federal?) audit of the Hawai`i Department of Land and Natural Resources. If necessary, make this a requirement for the State's receiving Endangered Species Act Section 6 funding for endangered species programs. Law enforcement, State leases of its forested lands, and the State's multiple-use policy for managing native forests, which often involves conflicting uses such as game management and native species protection, need to be focused on.

7) Finally, provisos on Federal funding for State programs are needed to insure that land management conflicts are eliminated or avoided. Pittman-Robertson money (excise tax from fire-arms and ammunition sales) is appropriated by the Fish and Wildlife Service to the Hawai`i Department of Land and Natural Resources for game management and endangered species programs. Also, Endangered Species Act Section 6 funds are appropriated by the Service to the Department for endangered species programs. The Fish and Wildlife Service needs to take a more active role in how these funds are spent and more specifically, the Service needs to identify conflicts in State programs that involve Federal funds.

Civil lawsuits filed under the Endangered Species Act and other environmental statutes are often necessary in making the involved agencies accountable for their actions and omissions relating to preserving biological diversity. As John Fitzgerald, one of the leaders in the Endangered Species Act Reauthorization Coalition put it, the large number of successful lawsuits filed under the Federal Endangered Species Act is an indication of the many opportunities for saving endangered wildlife missed by agencies due to lack of funding and aggressive enforcement.

It is extremely unfortunate that private citizens need to spend their time, energy, and money forcing public agencies to do what they are legally required to in the first place. For instance, it cost the citizens of Hawai`i $295,202.50 to protect the endangered palila bird's habitat on Mauna Kea. Protecting the habitat resulted from citizen lawsuits and was legally required of the Fish and Wildlife Service and Hawai`i Department of Land and Natural Resources to begin with. Couldn't that money have been better spent acquiring and managing native areas?

I hope that your Committee will use its power to pass legislation that will result in new statutes to preserve biological diversity, as well as laws to better implement and enforce existing ones.

The Sierra Club Hawai`i Chapter and I appreciate the opportunity to comment. If we can be of further assistance, please let us know. Thank you.

Respectfully Submitted,

Marjorie F.Y. Ziegler

Marjorie F.Y. Ziegler
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1100 Alakea Street Room 330
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Marie Morin. Congressmen Akaka and Scheuer. My name is Marie Morin. I am the representative of the Hawaii chapter of the National Audubon Society. The goals and activities of our society are outlined in my written testimony or our written testimony. The Chapter strongly believes that the maintenance of biodiversity is crucial to the long-term survival of the human species, not only because other species have inherent value, but also for practical reasons such as those that have been mentioned earlier. The Chapter also believes that biodiversity is best maintained by the preservation of all native species, including plants and insects within intact non-disturbed ecosystems. Less preferable ways of maintaining biodiversity include preserving disturbed ecosystems, captive or "farmed" species, or gene banks.

We agreed ahead of time that we would break the topics up so the two topics that I am going to emphasize are directly from my written testimony—enforcement and prevention of introductions. And I will speak about enforcement first. Federal enforcement of existing wildlife and endangered species laws is not adequate, due to lack of personnel and lack of direction and support from higher authorities. For example, the U.S. Fish and Wildlife Service has 1 Special Agent and 3 Wildlife Inspectors for the entire seven main islands of Hawaii, plus Guam and the American Samoa. This is absurdly small and considering that Hawaii has over 50 endangered species, it is just not adequate. In addition, State and Federal enforcement cooperation is minimal or non-existent and I would tend to go with the latter. Federal agents and state agents do not cross enforce the law and this is often done in other states so that needs looking into. If federal money is used to fund state law enforcement it should be tied to annual performance ratings, which are independently verified. A public information and education specialist is urgently needed in Hawaii to actively educate the public about federal laws and how they relate to the preservation of Hawaii's unique ecosystem. Now I am going to talk about introductions and I sort of think that there is an agency missing here today and I think the Department of Agriculture both federal and state probably should have been involved but anyway it is too late now.

Congressman **Scheuer.** Why don't you describe what their mission should be?

Marie Morin. I think it will come out in the rest of what I am saying here. New species of non-native plants and animals—here I include birds and insects and fish of course—are continually being introduced both accidentally and deliberately, into Hawaii from the mainland or foreign countries, or moved among the Hawaiian islands once they have become established on one island. Partly due to Hawaii's mild climate, some of these new non-native species become feral and spread as serious pests, which government and business then spend millions of dollars trying to control or eradicate. One entomologist estimated that an average of 19 new species of insects alone were introduced and established themselves in Hawaii each and every year between 1962 and 1976. Examples of such non-native introductions include: illegal snakes which are regularly found on Oahu; pest plants like gorse, clidemia, and banana poka, insects such as the Mediterranean fruit fly and mosquitoes; escaped caged birds which of course can cause serious agricultural damage and can also spread bird disease to native birds; and then a variety of feral mammals, which you have heard how they damage the Hawaii ecosystem.

A much stricter and more effective quarantine program is needed if we are truly serious about maintaining native biodiversity in Hawaii. This would require effective inspection of cargo, baggage, and mail, which I understand is a very touchy topic coming into Hawaii from foreign, mainland U.S. and military destinations as well as movement of plants and animals between islands. It is ironic that passenger baggage is inspected which goes back to the mainland, but not when it is coming into Hawaii. It would be far better to spend more money on inspecting and excluding rather than trying to undo the damage after the pest becomes established. Much of the money which is spent on management and research by the National Park Service, the U.S. Fish and Wildlife Service, and the U.S. Forest Service in Hawaii is spent trying to control or eradicate such non-native pestiferous species which I have mentioned above.

Additionally, native ecosystems as well as agriculture are continually impacted by the constant inflow of new insects. Hopefully we can learn a lesson from the introduced brown tree snake which became established on Guam; it has already been mentioned today how it eradicated most of the native birds; it is also a serious economic problem due to the fact that it causes power outages regularly across the entire island. This snake has already been transported to Hawaii at least three times, and will continue to be transported to Hawaii and other destinations via military or commercial cargo unless very strict inspection is instituted. New Zealand, an island country with biodiversity problems which parallel Hawaii's, has a good inspection and quarantine program which is worthy of study and emulation. Federal laws governing the definitions of injurious wildlife and plants as well as federal jurisdiction over injurious species trafficking need to be re-evaluated and strengthened based on ecological lessons which we have learned over the past 20 years. Thank you.

[The prepared statement of Ms. Morin follows:]

For the Protection of Hawaii's Native Wildlife

HAWAII AUDUBON SOCIETY

P.O. BOX 22832
HONOLULU, HAWAII 96822

January 11, 1989

To: Congressman Daniel Akaka and Congressman James Scheuer

From: Hawaii Chapter of National Audubon Society, a Conservation Organization

The Hawaii Audubon Society is pleased to be a part of this Congressional briefing on the preservation and maintenance of biological diversity in Hawaii.

The Hawaii Chapter was first organized in 1939; it is the state chapter of the National Audubon Society. The Chapter currently has about 2,500 members.

The Chapter's goals are: 1) to encourage public appreciation and preservation of wildlife and plants, 2) to preserve adequate populations of native species, 3) to preserve the environment, upon which all wildlife is ultimately dependent, 4) to foster public education and research on Hawaii's native wildlife, and 5) to fix stewardship responsibilities on public and private agencies for safeguarding all species threatened with extinction. Chapter members come from a wide spectrum of the community and include many of Hawaii's professional biologists and scientific educators, as well as the general public. Although the Audubon Society is often characterized as a birdwatching group, its activities and interests encompass all native species as well as environmental concerns which address the quality of life in general.

The Chapter holds monthly meetings and nature hikes, and publishes a monthly journal/newsletter. The Chapter also awards scholarships for conservation-oriented students, as well as grants for worthy wildlife or other environmental research, projects, or education. The Chapter regularly comments on environmental issues and tries to participate in environmental policy formation. Too often the Chapter has been forced to seek litigation as a last resort to force government to follow its own environmental laws and rules.

The Chapter strongly believes that the maintenance of biodiversity is crucial to the long-term survival of the human species, not only because other species have inherent worth, but also for practical reasons such as their potential use as medicines, or gene sources for improving domestic agricultural species. The Chapter also believes that biodiversity is best maintained by the preservation of all native species (including plants and insects) within intact non-disturbed ecosystems. Less preferable ways of maintaining biodiversity include preserving disturbed ecosystems, captive or "farmed" species, or gene banks.

In 1984, at a Symposium on the Protection and Management of Terrestrial Hawaiian Ecosystems at Hawaii Volcanoes National Park, a group of 144 Hawaiian biologists, science educators, and other interested people compiled a list of the "10 most-wanted management actions for terrestrial Hawaiian ecosystems" (see references). A few of the recommendations have been acted upon, but not surprisingly the list still is mostly current. The overall number one ranked action for Hawaii was to "identify and protect pristine and near pristine ecosystems with diverse assemblages of organisms". In other words, preserve biodiversity. The rest of this testimony will list ways we believe that the 101st Congress can help to maintain biodiversity.

1) Stabilization of Human Population As is true in most parts of the world,

population growth in Hawaii has not stabilized. Development, loss of habitat, pollution, and other problems are generated by this ever-increasing population, which is the single most important factor causing biodiversity loss. Hawaii Audubon urges the 101st Congress to strongly support efforts to stabilize human populations both nationally and internationally.

2) Prevent Non-native Species' Introductions New species of non-native plants and animals (animals includes insects, birds, and mammals) are continually being introduced, both accidentally and deliberately, into Hawaii from the mainland or foreign countries, or moved among the Hawaiian islands once they have become established on one island. Partly due to Hawaii's mild climate some of these new non-native species subsequently become feral and spread as serious pests, which government and business then spend millions of dollars trying to control or eradicate. Beardsley estimated that an average of 19 new species of insects alone were introduced and established themselves in Hawaii each and every year between 1962 and 1976 (see references). Examples of such non-native introductions include: illegal snakes which are regularly found on Oahu; pest plants such as gorse, clidemia, and banana poka which overrun and destroy native plant ecosystems; insects such as the Mediterranean fruit fly and mosquitoes; escaped cage birds such as Red-vented Bulbuls and parrots which can cause serious agricultural damage and spread pest plant seeds, as well as spread new bird diseases to the native birds; feral mammals such as mongooses and rats which can predate native species; and feral sheep, goats, pigs, and introduced deer which can seriously impact native vegetation. A much stricter and more effective quarantine program is needed if we are truly serious about maintaining native biodiversity in Hawaii. This would require effective inspection of cargo, baggage, and mail coming into Hawaii from foreign, mainland U.S., and military destinations as well as movement of plants and animals between islands. It is ironic that passenger baggage is inspected going back to the mainland, but not when coming to Hawaii. It would be far better to spend more money inspecting and excluding rather than trying to undo the damage after the pest becomes established. Much of the money spent on management and research by the National Park Service, U.S. Fish and Wildlife Service, and the U.S. Forest Service in Hawaii is spent trying to control or eradicate such non-native pestiferous species as are mentioned above. Additionally, native ecosystems as well as agriculture are continually impacted by the constant inflow of new insects. Hopefully we can learn a lesson from the introduced brown tree snake which became established on Guam and has now eradicated most of the native birds; it has also been a serious economic problem due to the power outages it causes. This snake has already been transported to Hawaii at least three tims, and will continue to be transported accidentally to Hawaii and other destinations via military or commercial cargo unless very strict inspection is instituted. New Zealand, an island country with biodiversity problems which parallel Hawaii's, has a fairly good inspection and quarantine program which is worthy of study and emulation. Federal laws governing the definitions of injurious wildlife and plants as well as federal jurisdiction over injurious species trafficking need to be re-evaluated and strengthened based on ecological lessons which have been learned over the past 20 years.

3) Enforcement of Existing Federal Laws Federal enforcement of existing wildlife and endangered species laws is not adequate, due to lack of personnel and lack of direction and support from higher authorities. For example, the U.S. Fish and Wildlife Service has 1 Special Agent and 3 Wildlife Inspectors for the entire seven main islands of Hawaii, plus Guam and American Samoa. This is an absurdly small staff, considering that Hawaii has over 40 endangered species.

In addition, State and Federal enforcement cooperation is minimal or non-existent. Federal agents do not enforce state wildlife laws, and state agents do not enforce federal wildlife laws, although this is often done in other states. Federal money used to fund state law enforcement should be tied to annual performance, which is independently verified.

Finally, a public information and education specialist is urgently needed in Hawaii to actively educate the public about federal laws and how they relate to the protection of Hawaii's unique ecosystems.

4) Accountability Who polices government? Unfortunately, conservationists in Hawaii frequently find themselves in the role of trying to force government to do its job protecting public resources such as rare ecosystems or endangered species. Some good plans, such as endangered species recovery plans, have been made but the implementaion of those plans requires money and motivation, both of which often seem to be in short supply. Ideally government could police itself, for example, by making sure it is accomplishing goals on a timely basis and that those goals are not contradictory. Paper plans are like paper refuges; they may look good, but they will not maintain biodiversity.

5) Acquisition of additional refuges and management of new and existing refuges The native forest birds and water birds do not have enough managed refuges on each island to ensure their long-term survival. The same is true for rare plants and invertebrates. Much worldwide research has been done in the past 20 years on minimum preserve size and minimum viable species population sizes, but this research has yet to be adequately implemented in Hawaii. The crush of development in Hawaii assures that habitats not secured in the very near future will probably be lost forever.

Although acquisition is the first important step, it must be emphasized that refuges must be actively managed in order to assure their long-term viability. This is especially true in Hawaii where pestiferous plants, insects, and other animals can become rapidly established and spread. Continual research on managing native ecosystems, such as monitoring, controlling, or eradicating non-native plants, animals, and diseases, is a vital necessity for effective management.

6) Loss of Biodiversity on Private Land Rare species or species assemblages on private land are sometimes getting much needed protection due to private organizations such as the Nature Conservancy, but frequently rare species do not have adequate long-term protection. A federal tax break or direct subsidy to private landowners, to maintain significant native ecosystems or rare species, is worth consideration.

Endangered species on private land have been a sensitive issue in Hawaii, and government has been unable to uniformly enforce wildlife and endangered species laws on private land due to lack of access (whether real or perceived). A clarification of access rights and also strong support from the highest federal levels is needed.

7) Counterproductive Federal Funding The Pittman-Robertson funds which Hawaii, like all states, gets for wildlife programs is heavily oriented toward hunting, partly due to the nature of the the funds. In Hawaii, hunting involves only non-native introduced animals like pigs, goats, sheep, deer, and game birds. Although hunting is enjoyed by some as a sport, and can have a beneficial impact by removing non-native animals which can seriously impact native ecosystems, hunting can also have a negative impact when non-native species are deliberately maintained in native ecosystems, especially where endangered native species or native ecosystems occur. Federal funding for one program (e.g. Pittman-Robertson wildlife funds) can work against the goals of another federally funded program (e.g. Section 6 Endangered Species funding) in the same area. The amount of federal money provided for long-term management,

research, and preservation of native species and native species assemblages should be increased and the amount of federal money provided for the maintenance of non-native species in native or nearly native ecosystems should be downplayed and phased out. Also, Pittman-Robertson programs in Hawaii should be closely re-evaluated to decide when and where non-native game animals are compatible with the goal of native biodiversity maintenance.

Also, programs of the U.S. Forest Service in Hawaii should be examined to assure that native forest maintenance, regeneration, and restoration is their highest priority rather than the introduction and propagation of non-native tree species.

8) Establish a Wildlife and Forestry Coop Unit at the University of Hawaii

Hawaii's biodiversity problems are more similar to problems encountered on other islands and in the tropics, rather than mainland temperate ecosystems. Yet the majority of biologists and foresters who work or have worked in Hawaii were trained on the mainland in completely different ecosystems. A wildlife and forestry coop unit in Hawaii could not only provide trained professionals in applied tropical resources but also could facilitate the continuing education of working biologists who often cannot stay current due to the remoteness of Hawaii and the difficulty of regularly attending mainland meetings.

The Hawaii Audubon Society thanks you for the opportunity to participate in this briefing.

Bruce R Eilerts
Bruce Eilerts
President, Hawaii Audubon

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thursday Jan 5, 1988 Honolulu Advertiser

Quarantine inspection chief seeks more inspectors

By Stu Glauberman
Advertiser Government Bureau

The state's plant quarantine inspection program on Oahu has deteriorated and needs more inspectors and equipment to do the job, state Agriculture Board Chairman Yukio Kitagawa said yesterday.

Kitagawa proposes to strengthen the state's anti-plant-pest enforcement program by increasing inspections of civilian and military arrivals and using a $90,000 portable X-ray machine to make random checks of baggage coming off commercial flights.

He also wants sniffer dogs to help check hand-carried baggage for undeclared plants and animals.

In his budget presentation to the House Finance Committee, Kitagawa said 12 more inspectors were needed to beef up the plant quarantine inspection force.

The price tag for all the add-ons requested over the next two years comes to about $500,000.

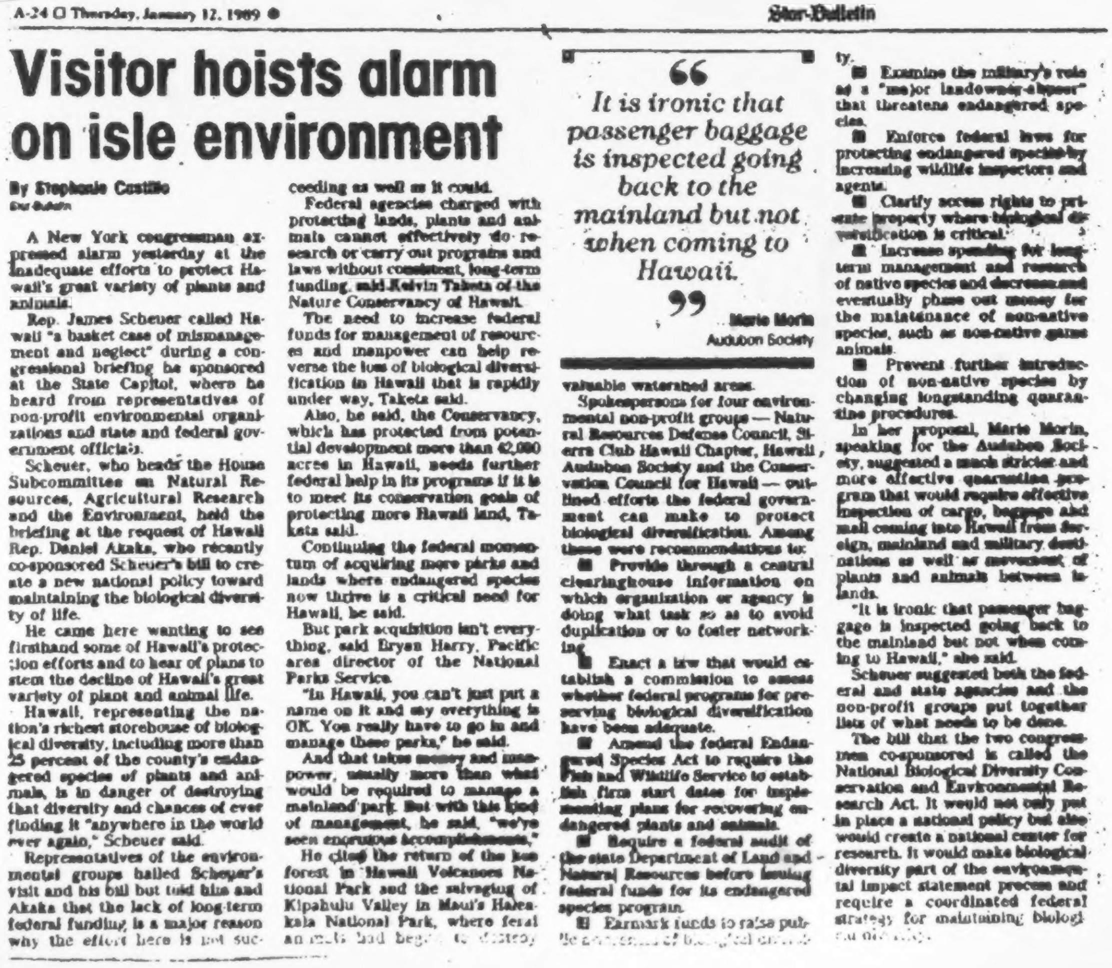
Plant quarantine inspectors are charged with inspecting arriving aircraft, passengers, cargo and mail to root out certain non-domestic animals, reptiles, insects, microorganisms and other materials deemed harmful to island agriculture.

Kitagawa said the statewide inspection staff grew by 11 between 1971 and 1988 to keep pace with the growth of airline service, especially on Neighbor Islands, but only four positions were added on Oahu, a 15 percent increase.

"In contrast, during this same period on Oahu, the number of arriving passengers increased by 138 percent, the number of cargo and mail parcels increased by 236 percent, and the number of nurseries requiring export certifications increased by 1,000 percent," Kitagawa said.

"In addition the number of restricted items requiring import permits and inspections increased by 197 percent between 1975 and 1988," he said.

"This has resulted in a steady decline in the amount of time inspectors can devote to inspections and therefore, a steady deterioration of the entire inspection program on Oahu."



Visitor hoists alarm on isle environment

By Stephanie Castillo
Star-Bulletin

A New York congressman expressed alarm yesterday at the inadequate efforts to protect Hawaii's great variety of plants and animals.

Rep. James Scheuer called Hawaii "a basket case of mismanagement and neglect" during a congressional briefing he sponsored at the State Capitol, where he heard from representatives of non-profit environmental organizations and state and federal government officials.

Scheuer, who heads the House Subcommittee on Natural Resources, Agricultural Research and the Environment, held the briefing at the request of Hawaii Rep. Daniel Akaka, who recently co-sponsored Scheuer's bill to create a new national policy toward maintaining the biological diversity of life.

He came here wanting to see firsthand some of Hawaii's protection efforts and to hear of plans to stem the decline of Hawaii's great variety of plant and animal life.

Hawaii, representing the nation's richest storehouse of biological diversity, including more than 25 percent of the county's endangered species of plants and animals, is in danger of destroying that diversity and chances of ever finding it "anywhere in the world ever again," Scheuer said.

Representatives of the environmental groups hailed Scheuer's visit and his bill but told him and Akaka that the lack of long-term federal funding is a major reason why the effort here is not succeeding as well as it could.

Federal agencies charged with protecting lands, plants and animals cannot effectively do research or carry out programs and laws without consistent, long-term funding, said Kelvin Taketa of the Nature Conservancy of Hawaii.

The need to increase federal funds for management of resources and manpower can help reverse the loss of biological diversification in Hawaii that is rapidly under way, Taketa said.

Also, he said, the Conservancy, which has protected from potential development more than 42,000 acres in Hawaii, needs further federal help in its programs if it is to meet its conservation goals of protecting more Hawaii land, Taketa said.

Continuing the federal momentum of acquiring more parks and lands where endangered species now thrive is a critical need for Hawaii, he said.

But park acquisition isn't everything, said Bryan Harry, Pacific area director of the National Parks Service.

"In Hawaii, you can't just put a name on it and say everything is OK. You really have to go in and manage these parks," he said.

And that takes money and manpower, usually more than what would be required to manage a mainland park. But with this kind of management, he said, "we've seen enormous accomplishments."

He cited the return of the koa forest in Hawaii Volcanoes National Park and the salvaging of Kipahulu Valley in Maui's Haleakala National Park, where feral animals had begun to destroy valuable watershed areas.

> *It is ironic that passenger baggage is inspected going back to the mainland but not when coming to Hawaii.*
>
> **Marie Morin**
> Audubon Society

Spokespersons for four environmental non-profit groups — Natural Resources Defense Council, Sierra Club Hawaii Chapter, Hawaii Audubon Society and the Conservation Council for Hawaii — outlined efforts the federal government can make to protect biological diversification. Among these were recommendations to:

- Provide through a central clearinghouse information on which organization or agency is doing what task so as to avoid duplication or to foster networking.
- Enact a law that would establish a commission to assess whether federal programs for preserving biological diversification have been adequate.
- Amend the federal Endangered Species Act to require the Fish and Wildlife Service to establish firm start dates for implementing plans for recovering endangered plants and animals.
- Require a federal audit of the state Department of Land and Natural Resources before issuing federal funds for its endangered species program.
- Earmark funds to raise public awareness of biological diversity.
- Examine the military's role as a "major landowner-abuser" that threatens endangered species.
- Enforce federal laws for protecting endangered species by increasing wildlife inspectors and agents.
- Clarify access rights to private property where biological diversification is critical.
- Increase spending for long-term management and research of native species and decrease and eventually phase out money for the maintenance of non-native species, such as non-native game animals.
- Prevent further introduction of non-native species by changing longstanding quarantine procedures.

In her proposal, Marie Morin, speaking for the Audubon Society, suggested a much stricter and more effective quarantine program that would require effective inspection of cargo, baggage and mail coming into Hawaii from foreign, mainland and military destinations as well as movement of plants and animals between islands.

"It is ironic that passenger baggage is inspected going back to the mainland but not when coming to Hawaii," she said.

Scheuer suggested both the federal and state agencies and the non-profit groups put together lists of what needs to be done.

The bill that the two congressmen co-sponsored is called the National Biological Diversity Conservation and Environmental Research Act. It would not only put in place a national policy but also would create a national center for research. It would make biological diversity part of the environmental impact statement process and require a coordinated federal strategy for maintaining biological diversity.

The Honolulu Advertiser Thursday, January 12, 1989 A-17

State and U.S. accused of not doing enough to protect the ecology here

By Barbara Hastings
Advertiser Science Writer

When it comes to protecting its native plants and animals, "Hawaii is a basket case of mismanagement and neglect," according to a New York congressman who's pushing for a national policy to conserve the nation's biological diversity.

Rep. James Scheuer, who chairs a House subcommittee on natural resources, agriculture research and environment, was co-chairing a meeting in Honolulu yesterday with U.S. Rep. Daniel Akaka to get information about Hawaii's ecology protection programs.

"Hawaii represents our nation's richest store of biological diversity, yet it has suffered the most from the ravages of development, carelessly introduced species and benign neglect on the part of federal authorities," Scheuer said.

Scheuer and Akaka are introducing a bill in the House that would establish "The National Biological Diversity Conservation and Environmental Research Act." It would set up a national conservation policy for flora and fauna, and require that environmental impact statements assess how development would affect that diversity.

James Scheuer
"Basket case of neglect"

Scheuer pointed out that Hawaii has 25 percent of the nation's endangered species. Of all the plants and animals in the country that have become extinct, a highly disproportionate 72 percent were in Hawaii.

Yet Hawaii remains "literally a treasure house . . . of glorious biological diversity," Scheuer said.

He admonished state, federal and private agencies trying to protect Hawaii's unique natural characteristics "to get into the trenches and preserve."

Presenting testimony yesterday were representatives of federal agencies, such as the National Parks Service, U.S. Fish and Wildlife Service, state agencies such as the Department of Land and Natural Resources, University of Hawaii specialists and private groups such as the Bishop Museum and the Nature Conservancy.

Scheuer pressed them to united and come up with "a consolidated laundry list" on what would help Hawaii preserve its unique ecosystem.

He reacted angrily when a University of Hawaii researcher, who is director of a UH-National Park Service resources studies team, told him he was unable to present testimony.

Cliff Smith said he'd been told yesterday that since part of his salary is paid by the Interior Department, any prepared remarks had to be approved first by the secretary of Interior.

Scheuer said another federal employee had just told him that staffers from his agency weren't permitted to meet with congressmen unless accompanied by an official representative of the agency.

"I'm really horrified that this administration would indulge in this sort of practice," Scheuer said. "I find that offensive to my very core."

Rick Scudder. Congressman Scheuer, Congressman Akaka, my name is Rick Scudder. I am the Chairman of the Conservation Council for Hawaii. We are one of the leading environmental organizations in the state and we focus our efforts on conservation action, environmental education, and public awareness of the problem, Joni Mitchell back in the '70s had a nice song about Hawaii—a paved over paradise, put up a parking lot and she went on to say, "you don't know what you got till it is gone." I think this is very important to keep in mind in that we are in a grim race against extinction as my good friend who passed away in May, Dr. Wayne Gagne's said in a paper which I'm willing to pass on to you about conservation priorities in Hawaiian natural systems.

I want to talk about several issues one of them we think is public awareness in Hawaii. If you were to go out to the average person downtown here and ask him what does he think about protecting biodiversity in the islands he would probably give you a very vague strange look. And he would probably say something like "oh, we should protect the myhah birds" or something to that effect. That is the level of awareness in the island. For many people it is, "gee I didn't know that." Like the firemen at Kahului Airport which I heard about earlier who were enthralled by what is happening and what needs to happen in the island.

One of the areas we are working on is every year we work with the National Wildlife Federation, of which we are the affiliate organization in the state of Hawaii and I'm sure that you are familiar with them in Washington, DC. We issue a wildlife education kit but because the materials that the National Wildlife Federation produces are always mainland oriented, we produce a local version of it. In this past year we focussed on the Hawaiian forest ecosystems and I have a copy of this for both of you gentlemen. And we did have a good cooperative effort in getting this published and out to the school system. We distributed about 5,000 copies to schools. So there is some environmental education occurring but it is occurring on an ad hoc basis basically. The curriculum that Dr. Duckworth mentioned is being worked on now for the school system. In the past years we have tried getting funding from the National Science Foundation for that similar curriculum and it was bounced twice by them. So the federal government hasn't really helped any in this area and its an area that I think needs to be greatly expanded. I am aware that there is an environmental education push in Congress and that needs to be assisted in whatever manner that you two can help on.

An area, another area that was overlooked today was the role of private land owners in maintaining biological diversity. When we talk about preserving ecosystems and habitats that support endangered species and other species of wildlife we tend to look at our maps and we seen all these lines drawn on the maps, all these artificial boundaries between conservation district and agriculture district, between urban and rural properties, and so on. These artificial boundaries don't reflect reality in terms of the ecosystem. Many of our important plants that contain rare and endangered species are in the agricultural districts in the state and there is little or no protection at all for those species. If a rancher wants to take his v–9 caterpillar out in the back and mow down the forest to "improve the pasture lands" he can do it with no permit, nothing. He just goes out and does it.

Congressional **Scheuer.** As long as he owns the land?

Rich Scudder. If he is the land owner he can just go out and do it. There is nothing that restricts him from doing it. Another thing, one of the things that the private land owners look to the state of Hawaii for its leadership and as an example there is a land manager. We often have the case where I will be talking to a rancher or a large land owner and they will say "you know the state of Hawaii owns this parcel right next to me and they are not protecting the birds and the species over there they do very little enforcement action. You know somebody bulldozed a road up there two years ago and they still haven't done anything about it and why should we bother protecting our property if the state is not taking a lead.

Congressman **Scheuer.** That is a good question. That is a good question they asked you.

Rich Scudder. It is a good question. And I am at a loss to say well that is what is happening it is the reality of the situation. And the reality of the situation is that we have a Board of Land and Natural Resources at the state level that is politically appointed, none of the members of which have any biological background. And yet they are in charge of the biological resources of the state of Hawaii. The Department of Agriculture whose primary purpose is promoting agriculture, they are also charged with throwing up the defenses for keeping out alien invaders. They are underfunded. They need much more support federally.

We now have a push in the state to expand the international airport's on the big island and Maui. In other words the federal resources are going to have to be increased to get the inspectors at those locations because you are going to have international arrivals and departures. You are going to need the inspection system that goes along with the airport. It won't be just Honululu and the big island that have the inspectors. So the Federal Department of Agriculture is going to have to add two to three more places and more manpower and more funds are going to be needed to keep the invaders out.

The role of the military has also been overlooked. The military especially on Oahu and the big island, is a major land owner and abuser. And in our current issue of our newsletter on the front page is an article on the current efforts to stop the U.S. army from continuously burning the habitat of the endangered tree snails in Makua Valley which is over here on the side of the island. They have refused up until very recently to do a formal consultation with the Fish and Wildlife Service to protect these species. And it was only us threatening to take them to court under the Endangered Species Act and giving them a 60 day notice with the assistance of the Sierra Club Legal Defense Fund that they bothered to take notice of the problem. Now we could go, I could go on and on with horror stories and fire fights and fire drills. I feel like a person standing under a large waterfall stuffing boulders in terms of doing my conservation work and on that day I'm the volunteer and everybody in conservation comes to volunteer.

Dr. Cliff Smith who earlier mentioned the gag order he received from the federal government also occurs at the state level. There are a lot of state employees that receive similar treatments in terms of their outside involvements and wanting to get involved but they can't. They either lose their research funds or their job or they get stuck off in the corner somewhere in the bureaucracy and you never here from them again. We are casually danced around this morning by the agency head. The example Mr. Paty said of shooting goats and sheep on Mauna Kea which he mentioned. He failed ~~to~~ mention it was also because the Sierra Club and Audubon Society sued the state of Hawaii and forced them to take that action. It wasn't something they took on their own. They fought it tooth and nail in the courts and spent maybe a half a million dollars fighting the court case. They could have used that money for better management, but they didn't.

Basically, what do we need from the federal government in terms of support? I think that you have heard many of it this morning. We need more money for research. We need more money for management. We need more money for enforcement and we need more money for public awareness and education. And I'm not just talking about a million dollars or a couple of million dollars. I'm talking about a couple of B-1 bombers or a Stealth bomber, I guess they are worth a little more, that is the kind of dollars we are talking about. If we really want to get serious about protecting biological diversity we got to put our money where our mouth is cause it is just not there now. Thank you.

[The prepared statement of Mr. Scudder follows:]

CONSERVATION COUNCIL
for HAWAII

A CITIZENS' ORGANIZATION PROMOTING ENVIRONMENTAL HEALTH AND EDUCATION,
CONSERVATION AND MANAGEMENT OF HAWAII'S NATURAL RESOURCES

February 6, 1989

James H. Scheuer, Chairman
Subcommittee on Natural Resources, Agricultural Research and Environment
Committee on Science, Space and Technology
House of Representatives
Rayburn Office Building
Washington, D.C. 20415

Dear Congressman Scheuer:

I want to thank you for taking the time to come to Hawai'i and conducting a hearing with Representative Akaka on maintaining this nation's biodiversity, especially in Hawai'i.

In the enclosed comments, I have attempted to put down in writing the comments I made at the hearing, but I'm sure that I've forgotten something. I've also included a few items which I think I missed, or skipped over at the hearing.

The Conservation Council for Hawai'i strongly supports congressional efforts that conserve and enhance the biodiversity of the Hawaii, and the mainland United States.

Please contact me if you have any questions on this.

Again, thank you for allowing us to testify on maintaining biodiversity.

Yours truly,

Rick Scudder

Rick Scudder,
Chairman

enclosure

cc: Rep. Akaka
Rep. Saiki
Sen. Inouye
Sen. Matsunaga
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Biodiversity Hearing

Comments by Richard J. Scudder, Chairman, Conservation Coucil for Hawai'i.

The Conservation Council for Hawai'i (CCH) is a citizen's organization promoting environmental health and education, conservation and management of Hawai'i's natural resources. CCH is the Hawai'i affiliate of the National Wildlife Federation (NWF).

You probably recall Joni Mitchell's song with the verses: "they've paved paradise and put up a parking lot," "They've taken all the trees and put them in a tree museum," and, a"You don't know what you've got till it's gone." She was singing about Hawai'i. Her song remains an expression of the current situation.

The Conservation Council for Hawai'i continues to work for the conservation of Hawai'i's native biodiversity in spite of serious odds.

My past friend and strong conservationist, Dr. Wayne Gagne of the Bishop Museum, wrote that, "we are in a grim race against extinction." He was referring to the loss biodiversity in Hawai'i and the need to take action now. I included in my materials at the hearing a copy of Wayne's article, which I believe points out many ways in which biodiversity in Hawai'i can be protected. Another source of ideas is a recently issued book entitled, Islands in a Far Sea - Man and Nature in Hawai'i - by John L. Culliney (San Francisco: Sierra Club Books, 1988) which should be read to learn of what has been lost in the islands and what might be done to protect what's left.

Several areas of concern which I will speak on are the need for increased public awareness, involvement by private land owners and the need for increased resources to defend biodiversity in Hawai'i, and elsewhere. Other topics of concern will also be mentioned, in addition to what the other environmental group spokespersons have stated.

Public Awareness:

The present state of environmental education is poor. Quite often, you will find the teachers using 'mainland' examples of species and habitats to teach local school children who have never seen, or may never in their lifetimes see, such mainland species. We need to "localize" the examples used.

The curriculum used by the state department of education has been evolving hit and miss, but is still neither comprehensive nor used state wide. Currently, the development of an environmental education curriculum has been funded by the MacArthur Foundation of Chicago, and its development is being conducted by the Bishop Museum. Two attempts were made previously to have the National Science Foundation support this important work, but they did not see fit to fund it.

The general public in Hawai'i has little awareness of the immense problem of the loss of biodiversity. Many persons on the street, if asked, would have a hard time even defining the term biodiversity.

Representative Akaka mentioned the firemen at the airport as an example of not knowing what was happening to Hawai'i's wildlife but who showed an interest in it once told about it.

Enviromental education efforts in Hawai'i are growing, but much more needs to be done by all concerned, especially the Federal and state governments and the private sector. We need a federal initiative to encourage state and local governments and private organizations to conduct environmental education.

As an example, we produce, with the support of a number of other organizations, the Hawai'i supplement to the National Wildlife Week teacher's kit produced by the National Wildlife Federation. This past year it focused on the theme, "Hawai'i's Forests are more than trees." A perfect example of a biodiversity theme. Over 5,000 teacher kits were produced and distributed to public and private schools in March, 1988. (a copy of the local supplement to the kit was submitted at the hearing)

This was a joint effort, but it was only scratching the tip of the iceberg in what needs to be taught to our younger generation. We don't have the funds to do it though. Perhaps a federal grants program to non-profits like CCH could be established to implement projects like this.

Private land owners:

Private land owners need good tax incentives to preserve biodiversity on their properties, otherwise they will just aim for the highest dollar return and write off biodiversity as something less valuable to them. The federal, state and local governments need to lead by example and show the private land owners that preserving biodiversity is something that should be done, for many reasons.

In Hawai'i, if the state doesn't set a good example in protecting biodiversity, the private landowners raise the valid question, "why should we do it as a private landowner if the state doesn't seem to care?" I'm sure the same question can be raised with the federal agencies, especially on the mainland.

In Hawai'i, we have a Board of Land and Natural Resources that is appointed by the Governor, and its current membership has little or no biological background. Yet, this board controls the fate of biotic diversity on all state-owned and conservation district lands in Hawai'i.

In Hawai'i we also have artificial boundaries drawn between conservation and agriculture districts in our land use designation system. In many areas, these boundaries were placed with little or any understanding of the ecosystems over which they were drawn. You therefore have private landowners with agriculture district lands which contain valuable ecosystems. These areas have none of the protection afforded conservation district lands, and allow for their destruction simply because of a man-made district boundary. We lost a valuable low-elevation ohia forest on the Big Island because of this situation in 1985.

Another problem with some private landowners is that they're afraid that letting biological researchers on their properties might lead to finding an endangered species there that might need protecting and therefore interfere with their development plans or lead to situations where they are criticized in public for the poor stewardship of their properties. One of Hawai'i's major estates doesn't let researchers on their properties because of this.

Another problem is the poor level of state enforcement efforts regarding its lands and the natural resources on all conservation district lands. Part of the problem is the low level of funding and staffing for such activities, another is the apparent lack of leadership or willingness to do a good job. The awareness level of the enforcement officers regarding the protection of biodiversity is probably not very high, since most are former policemen or security guards, and are not trained in resource management.

Some other suggestions:

We need funding for non-game wildlife management, so called "watchable wildlife." This program has gone unfunded for years now.

We need a major increase in the efforts to officially list endangered species in Hawai'i. This of course, includes funding. We find it hard to believe that the Fish and Wildlife Service only has one botanist in the local office working on listing the endangered plants for all of the Pacific islands, Hawai'i included, yet Hawai'i leads the list candidate species.

The federal and state Agricultural agencies need greater support in keeping out alien species, and controlling the pests that have gotten out-of-control already. We need more inspectors at the increasing number of international arrival airports (Maui, Kona) and a way to stop the illegal introductions of species through the mail and delivery services. Much more needs to be done with biological control alternatives for these alien species. Federal funding has been minimal, at best.

Federal programs which would adversely affect biological diversity need close scrutiny, such as the tri-fly eradication program which proposed widespread aerial spraying of malathion around the islands and would have greatly impacted native species. Military training activities, such as at the Makua Valley training area on this island, need to be examined as to their impacts on endangered species habitat. We recently forced the U.S. Army to stop live-firing near endangered species habitat which has been subject to fires.

Resource assessments quite often use remote sensing and aerial photography as basic information sources on which to base planning and management activities. In Hawai'i, we were not covered by the former National High-Altitude Photography Program, or as far as I know, the current National Aerial Photography Program. Hawai'i probably doesn't even have the funds to match what the federal agencies might be requiring for participation in the program. Also, there has been no landsat satellite coverage of the Hawaiian Islands, I believe, since 1980. So, this means that Hawai'i resource planners do not have the basic up-to-date information tools that are commonly found in use by mainland state and federal agencies.

In summary, what Hawai'i needs in order to protect and enhance biological diversity is greatly increased federal funding for research, management, enforcement and education activities. We are talking about tens of millions of dollars per year. Yes, it sounds like a lot of money, but saving the biological diversity of our nation's biological treasure-chest, the Hawaiian Islands, is much more important than funding a B-1 bomber, or a stealth bomber (we'd take the funds from either).

We thank you for the opportunity to provide comments on protecting biodiversity in Hawai'i.

Conservation Priorities in Hawaiian Natural Systems

Increased public awareness and conservation action are required

Wayne C. Gagné

We are approaching a turning point in the conservation of Hawaiian natural systems. The two major national parks harboring native biotic diversity—Hawaii Volcanoes and Haleakala National Parks (Figure 1)—have established management programs to protect native biota. The Fish and Wildlife Service has acquired its first National Wildlife Refuge (NWR) for native forest birds. And there is serious legislative consideration for funding both protective management and biotic surveys of the Hawaii Natural Area Reserves System, which has been largely a "paper park" system throughout its 17-year history.

Concern for Hawaiian species extinctions began surfacing more than 130 years ago; ". . . we would recommend that the [Royal Hawaiian Agricultural] Society look to the preservation of native insectivorous birds . . ." (Severance 1853, p. 85). Early Hawaiian botanists, especially J. F. Rock (1913), succinctly outlined the destruction of Hawaiian flora in their ecosystems. Yet, we are still in a grim race against extinction.

This race may be won only by a growing public awareness and increased conservation action to thwart the upward trends in endangerment and extinction curves. One encouraging sign is that there is a growing appreciation of rain forests as watersheds and reservoirs for quality water production for Hawaii's rapidly increasing population (Castillo 1985, De Leon 1981).

> We do not have the luxury of time to sort step-by-step the conservation priorities

It is difficult to rank conservation priorities, because we do not have the luxury of time to sort them step-by-step. Gagné (1975) and Stone and Stone (1984) have attempted to set priorities, and this article updates and reevaluates those efforts. Ideally, the measures outlined below should happen simultaneously.

Since people first inhabited the Hawaiian Islands, a large proportion of native plants, birds, and other terrestrial animals have been destroyed by introduced species and loss of lowland forests. Although Hawaii comprises less than 0.2% of total land area of the United States, more than 25% of the country's listed endangered species and 72% of recorded historical extinctions are species endemic to Hawaii. The Hawaiian archipelago has nearly as many candidate endangered animal species (639) as the remaining 49 states (761).

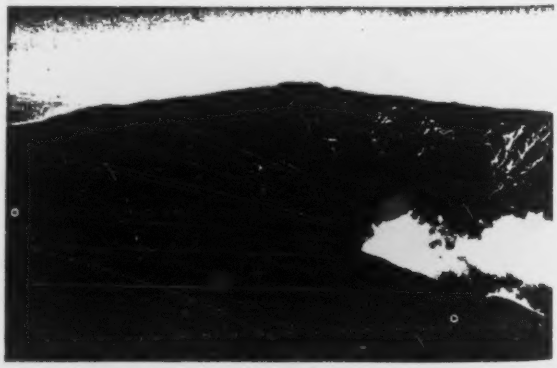

Figure 1. Haleakala Crater in Haleakala National Park. Photo © 1988 R. J. Shallenberger.

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It is likely that dozens of plant and hundreds of invertebrate taxa are becoming extinct. More alarming, however, is the fact that of the roughly 180 native terrestrial ecosystems that I, my colleagues, and others (Gagné and Cuddihy in press) have identified, no less than 88, along with the hundreds of native species that comprise them, will soon be lost forever unless representative samples are placed in protected reserves (Taketa 1987).

Vulnerability of native biota

Table 1 summarizes current estimates of the native biotic diversity of Hawaii. Extensive adaptive radiation produced thousands of species from only hundreds of successful colonizing ancestors. Most of the less vagile terrestrial invertebrates and plants tend to be single island endemics. Such biogeographic attributes contribute to the great vulnerability of this native biota to extensive landscape modifications or destruction. This vulnerability also applies to perturbations, such as grazing mammals, novel to this highly insular biota (Howarth 1985).

Table 1. Numbers of presumed original colonists, derived native species, and endemic species for the major groups of Hawaiian biota.

	Minimum number of original colonists	Number of native species	Number of endemic species (% endemism)
Microscopic marine algae[*]	?	ca. 5000	?(probably low)
Macroscopic marine algae[*][†]	?	ca. 500	54 (13%)
Ferns and fern allies 2[‡]	ca. 114	145	102 (70%)
Mosses[‖]	225	233	112 (46%)
Gymnosperms	0	0	0
Flowering plants	ca. 260[#]	ca. 970[**]	ca. 880 (91%)
Marine decapods[††]	?	ca. 600	ca. 150–180
Terrestrial molluscs[‡‡]	22–24	ca. 1000	997 (99%)
Marine molluscs[§§]	?	ca. 1000	300–450 (30–45%)
Terrestrial arthropods[‖‖]	300–400	ca. 6000	ca. 5950 (99%)
Mammals	2	2	2 (100%)
Birds[##]	ca. 25	ca. 135	109 (81%)
Fish[***][†††]	?	ca. 600	ca. 174 (29%)

[*] W. Magruder, 1987. Personal communication. Bishop Museum, Honolulu.

[†] Chock (1968).

[‡] C. H. Lamoureux, 1987. Personal communication. Bishop Museum, Honolulu. Endemic species number includes four taxa previously considered full species but now considered subspecies. The number also includes one species of *Schizaea* known only from fossil spores.

[§] W. H. Wagner, 1987. Personal communication. Bishop Museum, Honolulu.

[‖] Hoe (1979).

[#] Modified from Fosberg (1948).

[**] Wagner et al. (in press).

[††] R. H. Titgen, 1987. Personal communication. Bishop Museum, Honolulu.

[‡‡] C. C. Christensen, 1987. Personal communication. Bishop Museum, Honolulu.

[§§] Kay (1979).

[‖‖] Gagné and Christensen (1985). These numbers do not include 466 species of acari, since no author has attempted to quantify their endemicity (Goff 1987).

[##] Shallenberger (1984). The figures for birds include species and subspecies. Also included are 25 species of seabirds that breed in Hawaii.

[***] Randall (1976).

[†††] Gosline and Brock (1960).

The earliest depictions of the Hawaiian Islands were made by artists and naturalists accompanying Captains Cook, La Pérouse, Vancouver, and others on voyages during the late 18th century. Their drawings and narratives show an intensive agrarian society, with lowland areas below 500 meters mostly converted to crops or grassland (Figure 2).

Only recently have archaeologists and paleontologists ascertained the prehistoric impact of Polynesian colonists on the native presettlement biota (Kirch 1984). Vertebrates and molluscs present a better fossil record than other groups. Thus, we know that at least 45 species of land birds became extinct during the 1000 years of Polynesian occupation (Olson and James 1982). About a dozen of these extinctions were large, flightless rails, geese, and ibises that the Polynesians directly consumed. The remaining extinctions were mostly forest birds (e.g., honeycreepers and honeyeaters) that were presumably dependent on the former lowland forests.

Many extant native forest birds are represented in the lowland fossil record but now survive as relicts in the higher, cooler rainforests, which are not the most conducive habitats for these birds' continued survival. Enormous pelagic bird rookeries have also disappeared from occupied islands. What of the comparative legions of plants and invertebrates? There is evidence that entire genera and families of molluscs, such as *Carelia* and Endodontidae, were almost entirely obliterated at the time of Polynesian settlement (Gagné and Christiansen 1985). But the pollen and microfossil records have not yet been examined.

Whatever impacts the Polynesians had upon the native biota pale in comparison to the events of the last two centuries. Since the first Western contact, the outside world has poured into the Hawaiian archipelago. First came a phalanx of feral goats, sheep, cattle, pigs, horses, and rodents. Of the thousands of alien animals purposely or accidentally introduced, there are now more than 2000 alien arthropods, 50 alien land birds, and 18 alien mammals now established (Moulton and Pimm 1986, Simberloff 1986, Stone and Scott 1985). Numerous plant introductions, several of which were adapted to mammalian herbivory, rapidly naturalized (e.g., guavas [*Psidium* spp.] and South American mesquite, locally called *kiawe* [*Prosopis pallida*]). Approximately 900 alien plant species now constitute a naturalized flora roughly equal in number to the entire native flora (Wagner et al. in press).

During the mid-19th century, large areas were converted from native forests to pastures and sugarcane and pineapple plantations. Grazing lands alone now occupy 52% of the land area of the Hawaiian Islands (Ariyoshi 1986; Figure 3). Commerce with continental areas has had insidious effects. Port-of-entry quarantines and cargo inspections were only instituted early this century. But earlier, this Noah's ark of undesirable biota, including 3 rodent, 42 ant (Huddleston

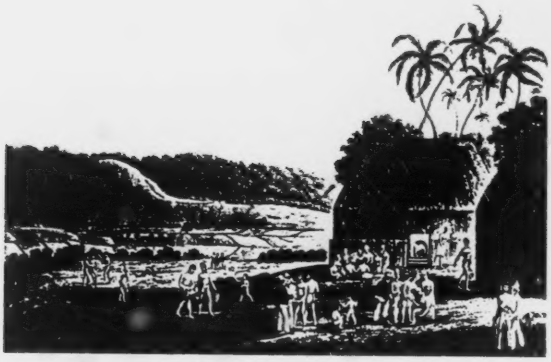

Figure 2. An early artistic depiction of the Hawaiian lowlands. This village of Macacoupah, Owhyhee Makakupa, Hawaii, was depicted in 1794 by Thomas Heddington. Courtesy Photo Archives, Bishop Museum, Honolulu.

and Fluker 1968), 4 mosquito (Hardy 1960, Zimmerman 1948), and numerous weed species, increased hardship for the native biota and human populace alike.

The growing affluence and aspirations of Hawaii's increasingly cosmopolitan population have led to further additions of alien biota. Species have been introduced for a variety of stated and unstated purposes—birds as songsters and for insect control, mongooses for rat control, and more than 8000 species of ornamental plants, about one-tenth of which naturalized (Wagner et al. in press). In addition, an undesirable cargo of plant and animal pathogens has arrived, and an average of 20 insect species have established each year (Beardsley 1979). For example, a 1.5-millimeter polyphagous bark beetle known locally as the coffee twig borer (*Xylosandrus compactus*) appears to be the most important factor in the impending extinction of the majestic dry-forest tree, the ***mehamehame*** (***Fluggea neowawrea***) (Gagné 1971).

Human efforts to right the biotic wrongs have resulted in some serious blunders (Howarth 1983, 1985). The mongoose eliminated the remaining flightless rails, but it had little demonstrable impact on rodents. Introduced carnivorous snails prey on native land molluscs with little impact on their intended target, the giant African snail (*Achatina fulica*) (Gagné and Christensen 1985). Legions (probably upwards of 900 species) of introduced parasitic flies and wasps had varying impacts on their target alien entomofauna, but they brought extinction to a number of native macrolepidoptera (Gagné and Howarth 1985).

During its first five decades the Hawaiian territorial government was largely controlled by a plantation oligarchy (Daws 1968). While this form of government denied effective power to most of the populace, the agricultural management's concerns about adequate water for plantation irrigation resulted in some protection of valuable watersheds in the remaining rain forests. Browsing and rooting mammals were then considered foes of these forests. Forest reserves were fenced against livestock. Feral goats, sheep, and pigs faced continual eradication pressure.

The situation changed in the mid-1950s when a "multiple use" philosophy prevailed in land-management agencies. Introduced mammals, such as Axis deer (*Axis axis*), black-tailed deer (*Odocoileus hemionus*), Mouflon sheep (*Ovis musimon*), and prong-horned antelope (*Antilocapra americana*) began to be managed for recreational hunting. Then degradation of native rain forests and certain other native ecosystems increased dramatically.

The advent of the federal Endangered Species Act some two decades later provided the first legal leverage for protection of native communities on state lands. For example, the nationally significant court suit, *Palila v. Hawaii Department of Land and Natural Resources*, which pits state and hunter interests against conservationists, is testing the concept of *harm* to the habitat of the endangered *palila*, an endemic honeycreeper, and the impact of feral sheep, goats, and Mouflon sheep maintained in the palila's critical habitat for game purposes (Gagné 1987).

Conservation priorities

Education. Hawaii still suffers from a lack of a constituency educated in the conservation of natural systems. This situation may not be fundamentally different from that in many mainland states. But so much environmental destruction is occurring in the islands that we do not have the luxury of either pristine areas or a slower pace of change.

Hawaii still lacks extensive programs in both the public and private educational sectors that would reach all levels on a systematic basis (Gagné and Gill in press). Environmental education is, at best, practiced only in a cursory manner and usually has little to do with conservation of Hawaiian natural systems. Usually, the teaching examples are derived from continental systems and species because the textbooks are written from the mainland perspective. Even at the university level here, relevant courses are few.

There is not, however, a complete vacuum; in addition to the government agencies, there are several organizations that variously address this educational problem. Some of the prominent organizations are the Moanalua Gardens Foundation, Hawaii Nature Center, Conservation Council for Hawaii, High School Hiking Program of the Sierra Club, and the Bishop Museum (the largest natural history museum in Hawaii). Unfortunately, most of these agencies are based on the island of Oahu. In concert their programs reach but a fraction of the school-age population and far fewer adults. Conservation education is the necessary first step in awareness development, from which concern and action may ensue.

Conservationists and educators are securing funding to address nature conservation problems statewide and from kindergarten on up. Their goal will entail writing or rewriting curricula from oceanic island perspectives and with local examples wherever possible.

But most youngsters pass through Hawaii's public and private educational systems largely without exposure to fundamental biological processes and natural systems of insular environments. Such students are not given the educational tools that would as adults enable them to make informed legislation or policy to conserve natural systems.

Conservation biology—natural systems. A bright side of the dim scenario painted above is the body of scientific literature that has been produced in the last 15 years pertinent to conservation of natural systems (see also Loope et al. this issue, Mueller-Dombois et al. 1981, Stone and Scott 1985). The resource management programs in Hawaii Volcanoes and Haleakala National Parks have been exemplary and nation leading in solving alien species problems. The Cooperative Parks Studies Unit based at the University of Hawaii in Honolulu produces technical bulletins, many of which address conservation and management of native communities. These institutions continue to attract a wide assemblage of researchers, including graduate students based at both local and mainland universities, to study topics relevant to conservation management.

Of a number of environmental groups present in Hawaii, The Nature Conservancy of Hawaii (TNCH) is the foremost private entity in the acquisition and protection of natural areas. The Hawaii Audubon Society, Hawaii Native Plant Society, and the Hawaii Service Trip Program of the Sierra Club (Hawaii chapter) also focus on conservation of natural systems. The other environmental groups usually pay more attention to various issues of the human environment.

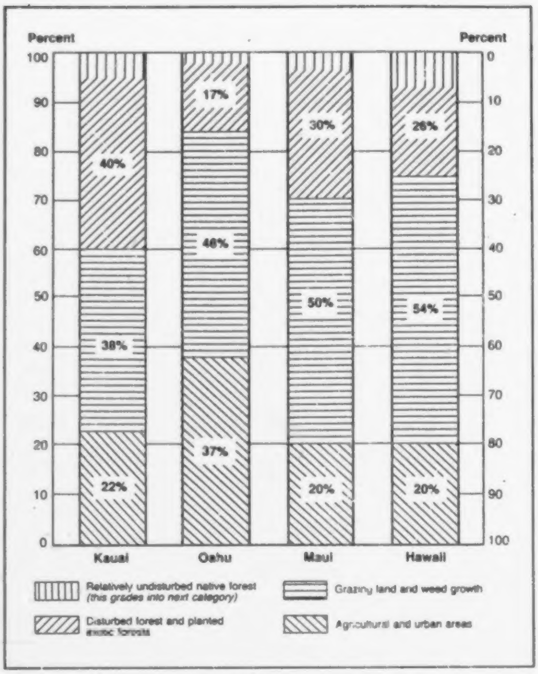

Figure 3. Land status and use on four main Hawaiian islands. (Areas given are approximations.)

Resource management activities presently consist of fencing and removal of feral goats and pigs and incipient weed infestations from national parks and TNCH lands and removal of cattle from state conservation lands. We are far from nullifying the obvious threats, and still much farther from addressing the unseen threats to natural systems. In concert the latter include insidious degradation of natural systems through continued attack on vulnerable native species. These threats include ants, slugs, rodents, mongooses, alien bird diseases, and a variety of alien plants. Resource managers have had to set priorities to deal with the worst of these threats, because simple mechanical removal is often impractical and the managers must consider unpopular alternatives such as toxicants and biocontrols.

Conservation biology—species. Conservation activities have focussed on the recovery of endangered birds, mammals, and plants. The impetus came from the near extinction of the nene or Hawaiian goose (*Nesochen sandvicensis*) and its salvation in captive rearing by Sir Peter Scott in England and Herbert Shipman and Ah Gat Lee in Hawaii (Kear and Berger 1980). Lee also demonstrated that the endangered koloa-mauli or Hawaiian duck (*Anas wyvilliana*) and Laysan duck (*Anas laysanensis*) could also be easily reared in captivity. The major problem facing the nene and Hawaiian duck is the biological hostility of their former range, because of introduced mammalian predators and habitat modification. An even worse scenario faces the critically endangered alala or Hawaiian crow (*Corvus hawaiiensis*), which has not yet been reared in captivity (Stine 1987); its essential habitat is being fragmented by logging of koa or Hawaiian mahogany (*Acacia koa*) (Duvall and Conant 1986).

Translocation of a species, in contrast to reintroduction of a species, has been successful only with the Laysan finch (*Telespyza contans*). Conant (page 254 this issue) cautions about translocation. Plans are afoot by federal and state agencies for captive rearing of some critically endangered Hawaiian forest birds, but lack of knowledge of even the basic biologies of most of these birds poses an enormous challenge that must be met before action can intelligently begin. Similar problems likely confront propagation and reintroduction of native plants.

Sunrise on the Haleakala crater. Photo © 1988 R. J. Shallenberger.

Legislative and legal actions

Game management. All legally hunted game animals in Hawaii are introduced species. The question arises, What is the place of sport hunting in Hawaii? Such continental concepts as sustained yield management and carrying capacity are inadequate when the native biota is not adapted to the game mammals. Alien game mammals damage native ecosystems at any population level. While introduced game birds have subtler habitat impacts, they nevertheless have been implicated as disease vectors to native avifauna (Scott et al., page 238 this issue, van Riper and van Riper 1985, van Riper et al. 1986).

Management of the hunting resource is subjected to strong political pressures of the hunting lobby to satisfy the 1.1% (11,500) of Hawaii's population who buy hunting licenses (State of Hawaii 1985). Unless the state government moves soon to limit game hunting specifically to lands now largely dominated by alien ecosystems, those who believe in the federal and state endangered species acts will have no recourse but to seek legal remedy. Otherwise, we will be condemning to extinction (or at least severe degradation) any native species and ecosystems outside of areas specifically delineated for their protection.

State authorities say that game species can somehow be "managed" to "nondamaging" levels by hunters (Nickolas 1987). In Hawaii, such concepts are biologically meaningless. In addition, hunters have become *personae non gratae* on large areas of private lands because of a few irresponsible individuals. As a consequence, hunters are often landlocked from the public state lands lying *mauka* (mountainward) of the private lands.

Large areas of remote rain forest in the main islands are being decimated by burgeoning numbers of feral pigs. Pig hunters seldom set foot in these areas. State game management officials admit to the ineffectiveness of hunters in controlling feral game populations: "When it becomes difficult to obtain game due to competition with other hunters or game seeking remote areas, hunters simply no longer go hunting. In effect, hunters cannot be *forced* to accelerate their hunting efforts" (Walker 1984, p. 48; emphasis added).

Pig-degraded rain forests are also watersheds for drinking water. When this resource becomes fit for little other than flushing toilets, as is, or was, the situation at Kula, Maui and at Kalaupapa, Molokai (Anonymous 1982, Castillo 1985, De Leon 1981), there is bound to be political fallout sooner or later. Subservience to the narrow hunting interests will not prevail when such conflicts become better known publicly. County water managers eventually will have to stop spending millions of dollars building elaborate water filtration systems to deal with symptoms (water contamination, siltation, and discoloration) and start dealing with the disease: feral pig degradation of the watersheds.

Endangered species listings. Local activists have found critical-habitat designations for federally listed endangered species to be a powerful legal tool to protect such species and their habitats. The *Palila v. Hawaii Department of Land and Natural Resources* case is a nationally significant test of the value of critical habitat and what constitutes "harm" to endangered species (Gagné 1987). However, since the Reagan Administration gained power, federal designation of critical habitat has come to a virtual standstill. Such designation seems now to occur only after litigation, as in the case of the endangered Hawaiian monk seal (*Monachus shauinslandi*) (Anonymous 1986a). Even recovery team selection, a component of the process of "recovering" endangered species, has only under threat of legal action proceeded locally for the hump-backed whale (*Megoptera novahollandiae*) (Anonymous 1987).

There are hundreds of Hawaiian plants and animals under review for potential listing as threatened or endangered species. This process has slowed to the pace of an endangered Oahu tree snail (*Achatinella* spp.). Only 19 plants have thus far been listed, and no invertebrates since the designation of the entire genus *Achatinella* several years ago. At this pace it would take several centuries to review and list all of the plant candidates alone, if they are still extant by that time.

Local biologists have become sufficiently frustrated with the snail's pace of listing that they have largely given up on it. This is doubly unfortunate because endangered species are the bellwethers for habitat designation and protection. Both governmental and private entities highlight endangered species preserves to attract monies for habitat acquisition. For example, the presence of a half dozen endangered birds no doubt helped in the 1986 federal purchase of the nations' first national wildlife refuge for rain forest bird protection—Hakalau Forest NWR on Hawaii Island.

Protected areas. Acquisition of natural areas for protection is inadequate unless followed up with funding and programs for permanent protective management. The National Park Service and US Fish and Wildlife Service have maintained a comparatively high profile in Congress, but they are still at the mercy of political and bureaucratic vicissitudes. TNCH is working to establish an endowment sufficiently strong to fund a permanent protective management program.

The state Hawaii Natural Area Reserves System (HNARS) still remains poor by comparison with these other agencies. There may be reason for optimism for HNARS, however. For the first time in the 17-year history of this 18-reserve, more than-100,000-acre "paper park" system, the state legislature has designated management and survey funding. Local activists are pressing for establishment of permanent funding for HNARS management, via, for example, establishment of a "natural area reserves fund" from an increase in the conveyance tax, an approach successfully used by many mainland states.

To measure Hawaiian natural-systems protection, Gagné and Cuddihy (in press) and TNCH workers delineated approximately 180 terrestrial natural systems throughout the islands. When TNCH applied a relative global (rangewide) rarity and endangerment ranking, 130 of these natural communities were imperiled globally, because of extreme rarity or factors that make them especially vulnerable to rangewide extinction. Of these 130 systems, only 28 are currently protected (i.e., they enjoy active management that reasonably assures their perpetuation); 20 are inadequately protected (i.e., they are subject to active management on only peripheral or nonexemplary occurrences, are only partially protected by natural factors, or are often subject to factors that could nullify management or natural protection). The remainder do not enjoy any protective management and are not otherwise naturally protected.

Curtail introduction of alien biota. The already difficult task facing managers of natural systems will likely worsen unless Hawaii's residents make substantive changes in their actions against alien introductions. Some plants and animals, such as known weeds, snakes, rodents, and insects and diseases, such as rabies and hog cholera, have long been perceived as detrimental, and various laws and quarantines have been promulgated to prevent their entry. However, there still lies a huge gulf between the perception and the dangers that other biota pose to natural systems.

Directors of some arboretums and botanic gardens are trying to save the world's tropical flora by introducing thousands of species to Hawaii into all climatic and elevational regimes (Weissich 1984). Some of these plants also naturalize and cause havoc for managers of natural systems (Gagné 1986). The advent of some two dozen mail-order suppliers of "beneficial" insects and other invertebrates (Anonymous 1986b) to customers worldwide is another cause for concern on behalf of native invertebrates (Gagné and Howarth 1985, Howarth in press).

Many species of ornamental plants continue to be introduced by the horticultural industry. Ornamentals and other exotic flora are so popular in Hawaii that they are often part of garage sales, church bazaars, and other fund-raising activities. But hundreds of these plants have already naturalized and compete with native vegetation (Yee and Gagné in press). In addition, such flora harbors a variety of arthropods and pathogens that escape detection or treatment at entry and then endanger the native biota (Simberloff 1986). Tourism is another factor in the present establishment of some two dozen new alien arthropods in the Hawaiian islands, each year (Beardsley 1979).

Silversword (*Argyroxiphium sandwichense*) in the Haleakala crater. Photo © 1988 R. J. Shallenberger.

Another source of woes is the powerful pet industry. Lowland freshwater streams, especially in urban areas, are often dominated by alien fish, the progeny of species dumped by pet owners (Maciolek 1984). A tropical menagerie of escaped or released cage birds (Moulton and Pimm 1986) and reptiles (McKeon 1978) continues to establish and spread. Certain of these species, such as the frugivorous birds called bulbuls (*Pycnonotus* spp.), spread seeds of invasive shrubs and trees into native areas, in addition to being themselves agricultural pests.

Should conservationists encourage cultivation of native biota rather than alien biota? Some argue that it is best not to mix gene pools of native species or grow them in Hawaiian islands where they are not naturally distributed. Another approach is to restrict alien introductions to those proven incapable of naturalizing and those more benign to natural systems. Some plant groups such as orchids and bromeliads have only sparingly naturalized, but it would be folly to predict that all related species would not do so. There is the added danger of insect and pathogen introduction with these plants, such as the recent establishment of the mosquito, *Wyeomyia mitchellii*, which breeds in bromeliad leaf axils (Shroyer 1983).

In summary, Hawaiian society is introducing a great variety of plants and lesser numbers of animals, while resource managers of natural areas fail to keep pace removing alien organisms or preventing their establishment in protected areas. For example, fountain grass (*Pennisetum setaceum*), a fire climax species, has ruined large areas in what was formerly native dry forest and is causing problems for Hawaii Volcanoes National Park resource managers who still lack herbicides or biocontrols to combat it. Similar scenarios are being played out in rain forests. For example, fire bush (*Myrica faya*) is invading mesic areas and recent lava substrates (Walker et al. 1986), and various ginger species (Zingiberaceae), banana poka (*Passiflora mollissima*), and raspberries (*Rubus argutus, Rubus ellipticus, and Rubus rosaefolius*) (Nagata and Markin 1986) are invading wetter sites.

We are still faced with the grim prospect of having one controlled alien plant merely being replaced by another naturalizing species, especially those weeds adapted to ground disturbance by introduced mammals, such as feral pigs (see also Loope et al. page 272 this issue). The primary forces attempting to protect native species are the resource managers within the National Park Service and TNCH, acting in conjunction with the Hawaii Service Trip Program of the Hawaii Chapter of the Sierra Club, the Hawaiian Native Plant Society, and other volunteer groups.

More scientist involvement in conservation activism. Scientists are often reluctant to involve themselves in conservation programs outside academia. But academic scientists, because of their field work, are usually the persons most familiar with the conservation problems confronting native organisms and ecosystems. Many scientists, in fact, owe their research careers to this native resource base. I feel that it is incumbent upon such scientists to help fight for the well-being of natural systems.

Acknowledgments

Figure 2 was made available by the Photo Collection of the Bishop Museum. I thank F. G. Howarth and anonymous reviewers for critical review. W. L. Wagner assisted in the preparation of Table 1.

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Congressman **Akaka**. Thank you very much to the whole panel. My only question to you, Mr. Scudder, would be what is being done presently to educate the Hawaiian public?

Mr. **Scudder**. At present there is a year-to-year environmental education program in the Department of Education. The staff are all temporary hires. They are on a year-to-year contract so it is very hard for them to develop and implement a long range education program when they have to be concerned about being hired next September. I mean it is very hard to plan your life that way. They receive very little funding or support in terms of the DOE or the Board of Education. Just last week the supervisor of education was talking about what a problem it was to have all these programs added on to the core curriculum and one of the ones he mentioned several times was environmental education. I view that as part of the core curriculum. If you really don't know what our basic biology is what we are really going to lose over the next five or ten years. That to me is a very basic problem it is like trying to drive blind.

Congressman **Akaka**. Congressman Scheuer has asked all of the panel to come forth with a coordinated action plan and it seems to me one piece is educating the Hawaiian public.

Rick Scudder. It is definitely needed. Every year we go around with a cup in hand and get funding from other mostly non-profit organizations, although I am happy to say that this past year the state did kick in some funding for this poster and educational kit which we developed. But it is a grind. There is no federal funds available to do this sort of thing and it would be nice to have the environmental education set up where non-profit organizations could do projects that could assist the state or do things the state couldn't do or didn't want to do and because of the way their staffing is set up and so on and so on.

I have 550 members in the Council. Many of them are state, and county and federal employees. Many of them are experts in their field and those are the folks that we could tap for these kinds of projects. And it is not where we would have to pass a law to do it. I mean, if we got the money from the federal government we would, and not in terms of our own volunteering. There are a lot of ways in which non-profit groups can help and it is a matter of over looking and going in the same direction I think. I think in the past, things are getting better in the state in terms of coordination but there as other panel members here have said, there are problems and we should not deny that they exist. Thank you.

Congressman **Scheuer**. You have given us a pretty good range of viewpoints, each of you, on what the successes have been and more importantly, what the failures are of federal policy and state policy. Could you tell us how you are acting together, sort of organizing your resources so that you get a bigger bang for the buck by coordinated action, eliminating duplicate action, overlapping, gaps and so forth? Is there any such effort to coordinate your efforts?

Marie Morin. Thank you for that question Congressman. I guess I was nominated to answer it by movement of the mike partly because I have for about 2 years been sort of the facilitator for what we call the environmental legislative network. It primarily deals with state legislature. We meet once a week during the legislative session and twice a month during the interim. Our purpose is strictly networking. We are not an umbrella lobbying group despite pressures to become that. What we attempt to do is some of what we are talking about—to share the information that we each accumulate in our daily circulations in our areas of interest and I hope we work to eliminate overlapping where it is appropriate but also coordinate and make our testimony and our adminstrative lobbying more effective because we have talked with one another. And this involves, I have a mailing list that covers about 40 organizations, not only on this island, but on other islands as well and 20 individuals are interested. So we have been doing this and there is a local organization you may have heard of, the Outdoor Circle, who has been very active. It is one reason that you don't see billboards in this state. They are responsible for that, but they have local branches. The Hawaii Outdoor Circle has generously given us a donation of over a thousand dollars to support the work that we are doing because it is strictly you pay for it among ourselves. So we are doing some of this, there has been some talking of trying to expand it so that we get some coordination with some of the actual agencies, state agencies, federal agencies. We haven't gone that far. I think maybe its sometimes all we can do to keep up with what we are doing.

Congressman **Scheuer**. In the field of environmental education, for example, raising the consciousness level, wouldn't there be some point to having a coordinated education program in which you all played a role in and all reached out to the groups that you have special networking capabilities, again where the whole, where the whole coordinated effort would produce more of a bang for the buck than each of you working separately?

Marie Morin. I agree. I know there was a conference to attempt to begin that last year and Mr. Scudder can speak more to that.

Rick Scudder. There are, we did have a conference on the Big Island regarding environmental education in the state. A number of frustrations came out and the Conservation Council presented it toward their volunteers to help spearhead and organize some coordination as to what should be done as to environmental education in this state. That has been ongoing and we have identified several areas that we thought needed fairly immediate addressing and one of them is making the positions in the Department of Education, a permanent position rather than a temporary, year to year kind of job. Those specific kinds of things are being worked on. In terms of the organizations working together, my organization does not try to do things that I know Sierra Club or Audubon is doing like leading hikes or doing field trips, field service work, things like that. In that sense we are not duplicating each other. CCH is not involved in buying lands and preserving like Nature Conservancy although we coordinate things with them. There may be times when they notice a conservation problem that needs addressing, they don't address it; they let us know about it or their members let us know about it and we'll try to address it if we have the time, volunteers or resources to do it. But I have one other thing to add and that is that at the state level we have no education section in the Department of Land and Natural Resources. I think almost every other state has such a section where the people working day to day with natural resources are also trying to educate the public of that state on what they are doing and why they are doing it. We don't have that kind of program here. We have piecemeal in Park and Wildlife; we have some projects, in Aquatic Resources a few projects, but we don't have an education division. We ought to get the word out to the public about the biological diversity problem in Hawaii. We don't have that. And at the Federal level, its by agency so again there is no coordinator.

Congressman **Scheuer.** It seems to me that it might be very helpful for your four groups, the four of you and any others that you may want to add to your groups to get together with the top staff professionals in the office of Congressman Akaka and Congresswoman Saiki, Senator Matsunaga and Senator Inouye and give them a list of the things that might be comparatively easy to do with the Federal agencies here, but even more important the state agencies. These four: two Senators and two Congressmen certainly have a lot of clout and influence and there may be some comparatively simple things like making those temporary positions permanent, like getting people with background in education and experience that are relevant to what they are doing. That may not be the most Earth-shaking thing in the world. It seems to me that you can use your Congressional delegation, four very well respected members, and now you have one of them in the party of the Administration and it seems to me that you ought to sort of cooperate in your efforts by sitting down with the staff people either together or separately. Maybe separately—there are ouly four of them, four different offices and then maybe together and work out a program that the members of the House, two very excellent House members, I can't tell you how much credibility and respect Congressman Akaka has in the House of Representatives, the same thing with the two Democratic Senators who I have known for a long time. But they don't have the staff, everybody is limited in staff resources. They are limited too. There are more things that can be done on a coordinated basis; that means you are going to save them a lot of time and that you are going to make their efforts much more cost-effective. And I would say that the place to start is with the four top staff people and meeting them together and then maybe meeting the four of them together with you and your colleagues working out a coordinated program of things that can be done without a lot of additional funding, modest changes, modest instrumental advantages; however, which could really help. Anyway it has been a very interesting panel and I congratulate you. You were four excellent witnesses and you all obviously are full of experience and full insights. Go about your mission and I appreciate that very much.

Group. Thank you very much.

Congressman **Akaka.** This brings to an end our briefing this morning. Again I want to thank all of you for attending, your testimony has been very helpful to me, especially. I want to thank Congressman Scheuer for his time and contribution here today. I look upon this briefing today and look forward to better awareness and better programs for promoting biological diversity. With that I want to say thank you very much. Mahalo!

Hawaiian Natural History and Conservation Efforts

What's left is worth saving

F. G. Howarth, S. H. Sohmer, and W. D. Duckworth

Stories of the Hawaiian Archipelago have been told innumerable times, and one of the most proficient tellers was Mark Twain who said of the islands that they are "the loveliest fleet of islands that lies anchored in any ocean." There has been a recent revival of interest in the natural history of these islands since the appearance of the popular works of Carlquist (1970, 1974) and the reports from the long-running *Drosophila* Project and the International Biological Program (Mueller-Dombois et al. 1981). Several special issues of magazines and journals have been devoted to the biota of these islands (Barrett 1975, Dodge 1982, 1987, Simon and Sudgen 1987, Ternes and Simon 1982).

Today tales of Hawaiian natural history are best told by the scientists who have been working with the various pieces of the organic evolution puzzle unfolding in Hawaii, and every such tale is permeated with as much mystery, wonder, and marvel as is any of the stories created by the fertile mind of Twain. However, these marvelous tales may have unhappy endings, because factors that have the potential to destroy much of the native plant and animal life were set loose the moment the first human set foot on these islands. We must pay more attention to and give more support to both the scientists and nonscientists who are working to avert the deterioration of natural Hawaiian ecosystems.

Recent biological discoveries should reinforce the conviction that Hawaii's native biota deserves protection

The archipelago

The Hawaiian Archipelago is much older than are the eight main islands that constitute the major part of Hawaii today. Indeed, the Hawaiian Archipelago is probably more than 70 million years old, whereas the oldest of the main islands, Kauai, is approximately 5 million years old. The small low islands and atolls—stretching from Kauai to Midway Island (which is dated at approximately 26–28 million years old) and Kure Atoll—are also part of the Hawaiian chain. Atolls were once fringing reefs that surrounded islands, some of which were perhaps as large as Hawaii Island is today. North of Kure Atoll, the archipelago continues as the Emperor Seamounts, some of which were once high islands. The chain extends all the way to the Aleutian Trench, where it is being subducted, along with the sea floor on which it stands, under the Asian Tectonic Plate.

The island chain was built in assembly-line fashion. As the sea floor tectonic plate moved northwest across a hot spot of volcanic activity, currently located just southeast of the island of Hawaii, the islands were carried away from the source of their lava flows. Subsidence and erosion began rapidly to wear away and diminish the size of each island in turn (Macdonald et al. 1983). Potassium/argon dates show that the Waianae Mountains on the islands of Oahu are approximately 3.7 million years old and that the Koolau Mountains, which form a spectacular background to the city of Honolulu on the same island, are approximately 2.6 million years old.

The Maui complex of islands is the next youngest, and the ages range from nearly 2 million years for Molokai to 800,000 years for Haleakala. The youngest and largest island is Hawaii, which was built by five volcanoes, and is commonly called the Big Island. The oldest dated lavas are only about 420,000 years old and are from the Kohala Mountains. Mauna Kea, which is 4205 meters high, is only about 380,000 years old. Kilauea is currently active and within the last year added even more territory to the southeastern part of the island. The formation of the island chain presents a remarkable scenario, especially when one adds the development of the biota.

The present-day main Hawaiian Islands are about 4000 km from the nearest continent and about 3200 km from the nearest high-island group of

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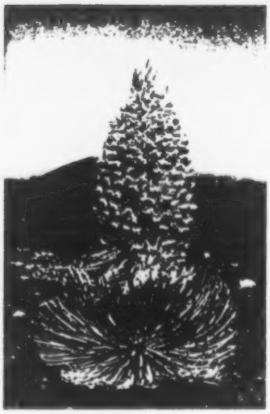

Figure 1. The silversword *(Argyroxiphium)* on Haleakala is one of the many native plants unique to Hawaii. Photo: G. Carr.

any size. They are the largest and most isolated group of oceanic islands on the earth. Before people arrived, any propagule would have had to travel that great distance on its own. But if it successfully colonized the new location, it would have had nearly unlimited opportunity to adapt to the various environments available.

Organisms did radiate into those environments, eventually producing a plethora of forms. Many of the presently known native Hawaiian flowering plants (Figure 1) are the result of spectacular speciation: over 22% of the genera have at least 6 (up to more than 50) native species.

Organisms occurring in a given area, such as the Hawaiian Islands, without the aid of human dispersal are said to be native. Organisms that are native and found nowhere else are called endemic.

Plants and animals have to be mobile and adaptable to survive and prosper in an oceanic setting like Hawaii. They have to be able to leave sinking, eroding islands and reach the newer islands continuously arising in the southeast. Probably few native species live on the same Hawaiian island that their ancestors originally colonized. The founders of the large genera are likely to have arrived before the present-day main islands began to form.

Not all types of organisms are represented, however, on the Hawaiian Archipelago. There are, for example, no native gymnosperms. A host of plant families are also missing. In addition, there are no reptiles, and bats are the only native terrestrial mammals. Relatively few bird families and only two butterflies are native to the islands. Approximately half the insect orders, and only 15% of insect families, are represented in the native terrestrial fauna (Mueller-Dombois et al. 1981, Zimmerman 1948).

Figure 2. How many generations to come? A frigatebird and its young on Midway island. Photo © 1988 R. J. Shallenberger.

The early colonists that were successful, however, evolved to exploit many ecological roles and give Hawaii a remarkable biotic diversity. Birds (Figures 2 and 3), snails, insects, spiders, and a few other invertebrate groups are the major groups represented in the native fauna, and some of the world's premier examples of adaptive radiation are found in Hawaii. Approximately 270 original colonists are hypothesized to have given rise to the approximately 1000 species of Hawaiian flowering plants known today. However, the data for insects is even more impressive: only 300–400 insect colonists evolved into an estimated total Hawaiian fauna of well over 10,000 species. The most extreme case is the remarkable Hawaiian Drosophilidae, comprising over 800 species, which evolved from only one or possibly two founders (Kaneshiro, page 258 this issue).

Each island was colonized by dispersal of elements of the terrestrial biota from the neighboring, usually older, islands, with rarer infusions of propagules from longer distances. Interisland dispersal was a relatively rare event within many groups, allowing divergence from ancestral forms, so that, for most groups, single island endemic species are the rule, with close relatives found on neighboring islands. Much of island speciation is envisioned as founder events (e.g., as described for *Drosophila* by Carson and Templeton 1984).

Laboratory for evolutionary ecology

This isolation, together with the increasing ages of the islands and great habitat diversity (Figure 4) within each island, makes the Hawaiian Islands an ideal laboratory for research on evolutionary ecology. Each island can be viewed as a minicontinent, because communities and ecosystems on each island developed independently from across-water colonists. Interisland comparisons on community structure, niche breadth, resource partitioning, and species packing allow one to estimate the role of time in evolutionary and ecological processes, as well as to recognize unifying principles.

The nemobiine cricket genus *Caconemobius* represents a microcosm of these evolutionary phenomena (Howarth 1987). One recently discovered species, which inhabits rocky seacoasts on all the main Hawaiian Islands, is wingless, lives amongst boulders in the wave splash zone, and feeds on the flotsam stranded on the shore. Being halophilic, it appears to be able to survive interisland voyages on the open sea. On at least four islands, inland fresh water species, all of which also exploit only wet rock habitats, have evolved. On Kauai an undescribed species lives on wet cliff faces, as perhaps does the poorly known *Caconemobius schauinslandi* on Molokai. On both Maui and Hawaii Islands, at least two blind cave species each have evolved. In addition, on Hawaii a remarkable surface species, *Caconemobius fori,* evolved that exploits wind-borne debris only on the youngest unvegetated lava flows on Kilauea Volcano (Howarth 1979). The cave *Caconemobius* evolved independently on Maui and Hawaii, yet the degree of convergence is surprising (Howarth 1987).

In higher plants, there are many parallels to this radiation. The beach scaevola, *Scaevola sericea,* for example, is believed to have given rise to species dwelling in the mountain forests (Gillett 1966), and Carr (1987) postulated that the native tarweeds (Madiinae) and beggar's ticks *(Bidens)* have radiated both morphologically and physiologically as apparent adaptive shifts to exploit novel habitats.

Conventional wisdom has assumed that such young isolated islands, with their limited numbers of higher taxa, must have many ecological niches unexploited. However, recent discoveries in paleontology (Olson and James 1982) and ecology (Howarth 1987, Mueller-Dombois et al. 1981) led to questions about this assumption. Even on youthful Hawaii Island, both caves and barren lava flows support communities of species, many of which are obligately adapted to their specific high-stress habitat within the less than one million years of the island's existence.

Subterranean and aeolian (wind-supported) ecosystems have evolved on all suitable habitats within the islands. This observation indicates that such development is a general phenomenon. It also indicates that nutrients are continually lost from the more conventional ecosystems in sufficient amounts to support additional systems on otherwise barren substrates (Howarth 1987). Presumably such energy is also being exchanged between the conventional ecosystems. Such interdependence among ecosystems should be included in studies of nutrient cycling.

It is not unusual that five of the nine known species of *Caconemobius* are not yet named. In every native arthropod group critically studied using modern methods, especially field biological studies, new species are discovered. Often when a new species is discovered on one island, we successfully predict the existence of a related species in similar habitats on the other islands. Even within the relatively well-studied Drosophilidae, over 200 species remain undescribed in collections, and more species are continually being discovered. A modern invertebrate survey under the aegis of the B. P. Bishop Museum in Honolulu is being planned for the next decade to update knowledge of the arthropods and land snails in Hawaii.

Figure 3. The redfooted booby and its young. Photo © 1988 R. J. Shallenberger.

One of the more remarkable adaptive shifts discovered in recent years is that of the predatory moth larvae in the genus *Eupithecia* (Montgomery 1983). These inchworms (family Geometridae) are highly specialized ambush predators, which capture active

Figure 4. Hawaii provides diverse habitats. (Left) Akaka Falls on the island of Hawaii. (Right) Young lava flow on Mauna Loa supports an Ohia tree. Photos © 1988 R. J. Shallenberger.

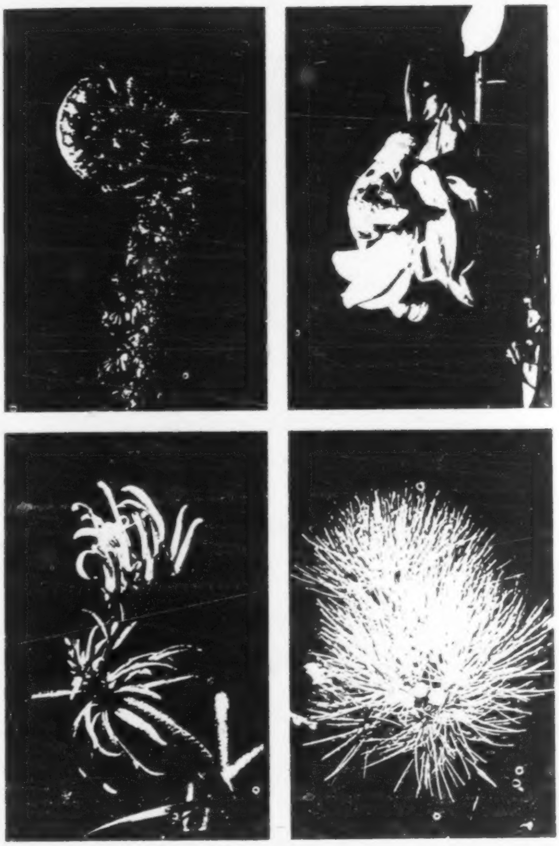

Figure 5. Native Hawaiian flora. (Top left) A *Sadleria* fiddlehead on Maui. (Top right) *Vicia*. (Bottom left) Kolii (*Trematolobelia*) on the Koolau summit. Photos © 1988 R. J. Shallenberger. (Bottom right) Ohia-lehua (*Metrosideros polymorpha*). Photo: R. Gustafson.

prey—insects, spiders, and other arthropods—rather than being phytophagous like their relatives and nearly all other Lepidoptera. More than a dozen predatory species are known to date, each of which is adapted to perch and wait in ambush on a specific substrate, such as leaf edges, fern fronds, twigs, mosses, or leaf litter. Each species is remarkably camouflaged, both morphologically and behaviorally, to its perch (Montgomery 1983). These predatory *Eupithecia* species are assumed to share a common ancestor with *Eupithecia monticolans*, the only phytophagous Hawaiian *Eupithecia* species. Its larvae feed on flower stamens of *Metrosideros polymorpha*, a protein-rich food. This diet can be considered a preadaptation to the food shift.

Major gaps in the natural history of Hawaiian birds also exist, and the surviving species provide remarkable systems for important research in evolutionary ecology (Conant, page 254 this issue; Freed et al. 1987; Scott et al., page 238 this issue). There have been many extinctions and Hawaiian forests cannot be considered pristine, but, in some montane rain forests, native bird densities are the highest recorded anywhere in the world (Scott et al. 1986).

The fight against extinctions

Hawaii has lost so much natural diversity since the arrival of humans (Kirch 1982, Olson and James 1982) that one might despair that nothing is left worth saving. Two-thirds of the bird species, including all the flightless species; over one half of the endemic land snails; and untold numbers of insects have already been lost. About 30% of the remaining native flora (Figure 5) are endangered species candidates. Against these odds, does any native species have a chance to survive? The resilience displayed by the surviving native species provides an optimistic answer.

Recent biological discoveries, including new species and new concepts in evolution and ecology, discussed in this issue, should reinforce the conviction that the native Hawaiian biota deserves protective management. Recent research and protective management actions in national parks, nature conservancy reserves, and national wildlife refuges demonstrate that native species benefit from appropriate conservation programs and that conservation of the remaining native biota is possible (Gagne, page 264 this issue; Mueller-Dombois et al. 1981; Stone and Scott 1985).

In this issue, J. Michael Scott et al. (page 238) bring us up-to-date on the status and conservation priorities concerning Hawaii's native birds. Sheila Conant (page 254) suggests caution in viewing translocation of endangered species as a solution for preventing their extinction. Kenneth Kaneshiro (page 258) reports on behavioral research on the Hawaiian *Drosophila* in the quest to decipher the genetic basis for the speciation process. Wayne C. Gagné (page 264) summarizes the conservation priorities and the history of conservation efforts in Hawaiian ecosystems. Lloyd Loope et al. (page 272) compare the conservation biology of Hawaii and the Galapagos and conclude that managing nature reserves in isolated islands may prove to be no more difficult than doing so in many fragmented continental reserves.

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